

International Diabetes Federation



Diabetes and Ramadan: Practical Guidelines

International Diabetes Federation (IDF), in collaboration with the Diabetes and Ramadan (DAR) International Alliance

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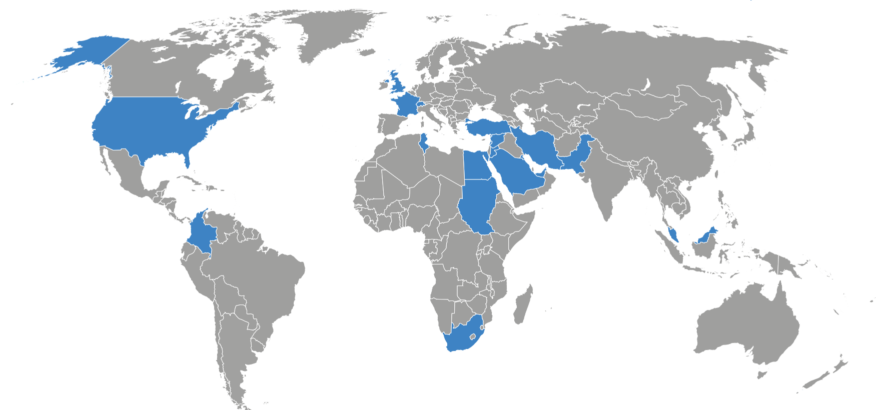
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Preface

Ramadan is the ninth month of the Muslim calendar and the daylight fasting that accompanies it is one of the five pillars of Islam. Fasting during Ramadan is compulsory for all healthy adult Muslims, although exemptions exist for people with serious medical conditions, including many with diabetes. Nevertheless, a majority of individuals with diabetes see the fast as a deeply meaningful, spiritual experience, and most will participate, sometimes against medical advice.

The International Diabetes Federation (IDF) has described diabetes as "one of the largest global health emergencies of the 21st century".[1] This global epidemic includes countries with sizeable Muslim populations, where the comparative prevalence of diabetes is well above the global average. Of further concern, the number of patients with diabetes in these countries is predicted to rise dramatically over the next 25 years.[1,2]

Ensuring the optimal care of the many patients with diabetes who fast during Ramadan is crucial. The IDF and Diabetes and Ramadan (DAR) International Alliance have therefore come together to deliver comprehensive guidance on this subject. The *IDF-DAR Practical Guidelines* provide healthcare professionals (HCPs) with relevant background information and practical recommendations to enable them to help patients with diabetes participate in fasting during Ramadan while minimising the risk of complications. The guidelines cover several key topics, including epidemiology, the physiology of fasting, risk stratification, nutrition advice, medication adjustment, and the implementation of recommendations. One of the recurring themes throughout the guidelines is the importance of individualisation and education within a diabetes management plan.

We hope that the comprehensive content presented in the *IDF-DAR Practical Guidelines* will greatly enhance knowledge surrounding the issue of diabetes and Ramadan fasting, thereby empowering HCPs to give the most up-to-date advice and the best possible support to their patients.

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[1]International Diabetes Federation. IDF Diabetes Atlas (Seventh Edition). 2015; Available at: http://www.diabetesatlas.org/resources/2015-atlas.html. Accessed 09 February 2016. [2]Pew Research Center. The future of world religions: population growth projections, 2010-2050. 2015; Available at http://www.pewforum.org/files/2015/03/PF_15.04.02_ProjectionsFullReport.pdf. Accessed 25 February 2016.

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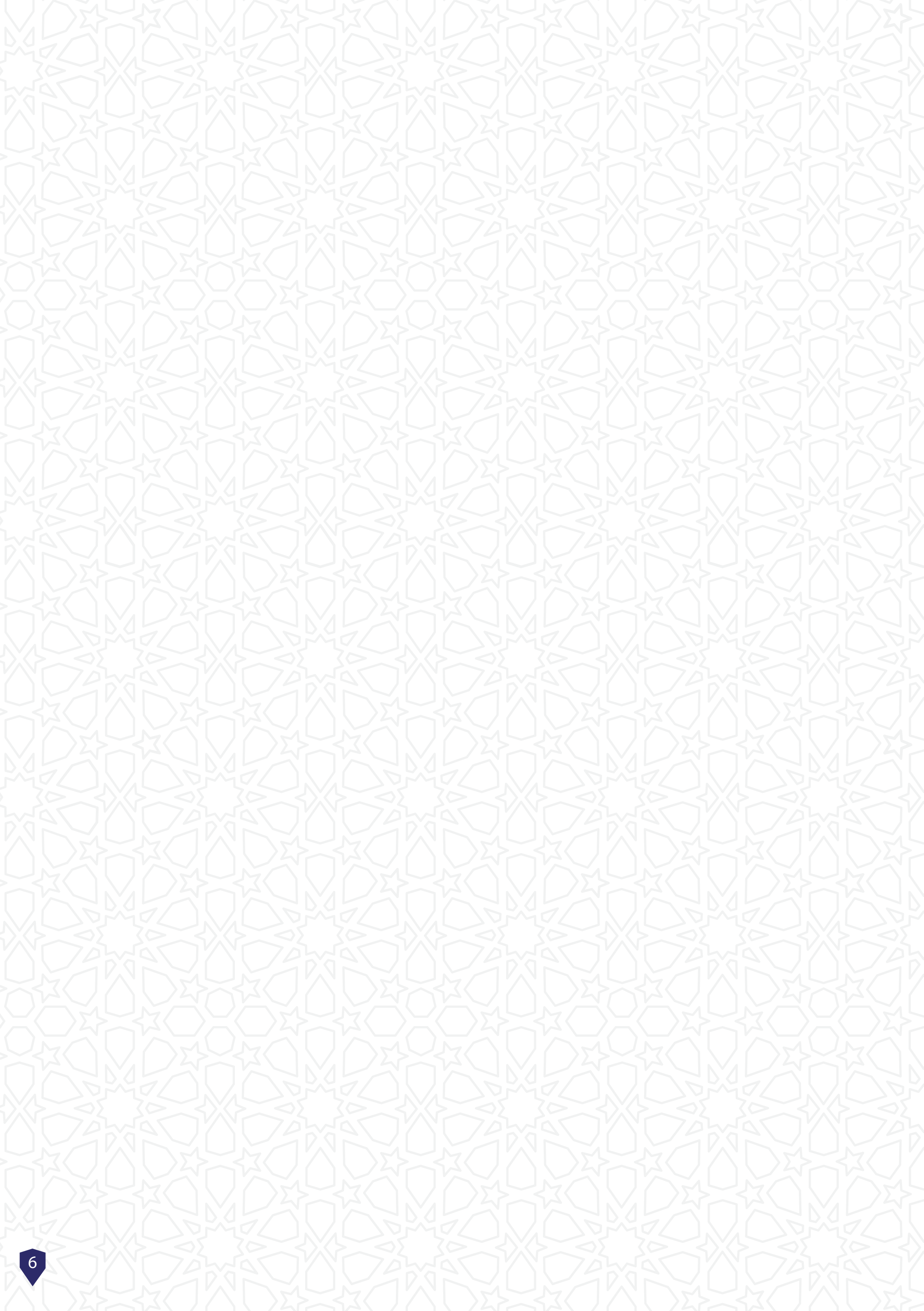
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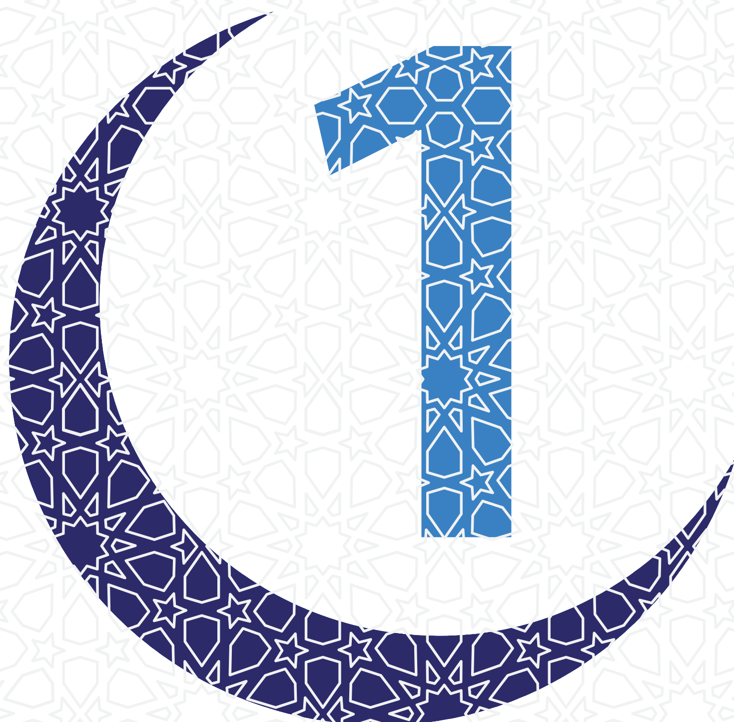
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Chapter 1. Introduction to the IDF-DAR Practical Guidelines

Mohamed Hassanein, Khalifa Abdallah & Mehmet Akif Buyukbese

1.1 Ramadan fasting regulations

Fasting during Ramadan is one of the five pillars of Islam and commemorates the time when the Holy Quran was revealed to Muhammad. The month-long (29–30 day) fast is obligatory for all healthy Muslims who have reached puberty, and is a time for spiritual contemplation and seeking nearness to God. Followers must refrain from eating and drinking between dawn and sunset, and must also abstain from using oral medications, sexual activity and smoking. It is believed that spiritual rewards for good deeds are multiplied during Ramadan, and there is an intense desire to participate in fasting, even among those who could seek exemption, such as the elderly, children, the infirm, and pregnant women. Missed fasts should be completed at other times; for example when health is restored or after the delivery of a baby. Fasting outside of Ramadan (when the rest of the community is not observing a fast) can be challenging, and this may discourage people from taking advantage of granted exemptions. Those who are permanently incapacitated can compensate by Fidya, a donation of food or money to the poor, for every day's fast that is missed. The timing of Ramadan is based on the lunar calendar (355 days per lunar year), which is shorter than the Gregorian (Western) calendar, and therefore Ramadan occurs 10–11 days earlier every year. This means that the duration of daylight fasting varies according to the time of year in which Ramadan falls. In some parts of the world, daylight can be as long as 20 hours in the peak of summer. Climate conditions also vary according to the date of Ramadan, with people fasting in very dry and hot weather some years and cold temperatures in others.



Many Muslims, even those who could seek exemption, have an intense desire to participate in fasting during Ramadan

1.2 The need for practical guidelines on diabetes management during Ramadan fasting

The management of people with diabetes who fast during Ramadan is mostly based on expert opinion rather than medical evidence gained from clinical studies. Muslims living as a minority in any country, including the USA and many countries in Europe, may need extra attention since healthcare professionals (HCPs) who are not experienced in dealing with fasting people with diabetes might not consult or even be aware of published recommendations [1]. Evidence-based guidelines are important and, although the evidence available in this area continues to increase, more randomised controlled trials are needed to fully answer questions related to Ramadan fasting and diabetes, such as:

- Is fasting during Ramadan associated with a significant risk?
- What are the criteria that predispose patients with diabetes to increased risk during fasting?

- What is the most appropriate oral anti-diabetic drug(s) for patients with type 2 diabetes (T2DM) who fast during Ramadan?
- What is the most appropriate type and regimen of insulin for patients with diabetes who fast during Ramadan?



Most of the guidance available for the management of diabetes during Ramadan represents expert opinion rather than medical evidence

Although the results from new clinical trials will provide much needed data in the future, there is an immediate requirement for practical guidance for the many Muslims with diabetes planning to fast over the coming years. The *IDF-DAR Practical Guidelines* aim to address this need by providing HCPs with both background and practical information as well as recommendations, allowing them to deliver the best possible care and support to the patient.

1.3 Epidemiology of diabetes in Muslim populations

In 2015, the number of people living with diabetes globally was estimated to be 415 million, with a 55% rise expected by 2040 [2]. The number of patients with diabetes in the Middle East and Africa – a region where a high proportion of inhabitants are Muslim – is predicted to more than double by 2040. A similar increase is expected in South East Asia, another area where Islam predominates [2].

Ramadan is widely observed across the world. A recent survey in 39 countries involving over 38,000 Muslims reported that a median of 93% fasted during Ramadan [3]. The Epidemiology of Diabetes and Ramadan (EPIDIAR) study performed in 2001 found that 42.8% of patients with type 1 diabetes mellitus (T1DM) and 78.7% of those with T2DM fasted for at least 15 days during Ramadan [4]. More recently, the 2010 CREED study reported that 94.2% of patients with T2DM enrolled in the study fasted for at least 15 days, and 63.6% fasted every day [1]. Therefore, Ramadan has a major impact on the management of diabetes in the Muslim population. More detailed descriptions of the EPIDIAR and CREED studies, along with further epidemiological data can be found in Chapter 2 of this booklet (*Epidemiology of Diabetes and Ramadan Fasting*). With so many Muslims with diabetes deciding to fast, the importance of practical diabetes and Ramadan guidance becomes evident.



With so many Muslims with diabetes deciding to fast, the importance of practical diabetes and Ramadan guidance becomes evident

1.4 Physiological effects of fasting, and potential risks to people with diabetes

Fasting during Ramadan has a number of physiological effects on both homeostatic and endocrine processes. In patients with diabetes, these changes and the type of medication being taken to treat the condition can be associated with the development of complications such as hypoglycaemia and hyperglycaemia [5]. Ramadan fasting not only alters the timings of meals but it may also disturb sleeping patterns and circadian rhythms, all of which can affect a person's metabolic state. Understanding these changes can help with the management of diabetes during Ramadan. Chapter 3 (*Physiology of Ramadan Fasting*) takes a closer look at the effects of fasting on the body of both healthy individuals and those with diabetes. The impact of fasting on glucose homeostasis is of particular importance when considering the risks to people with diabetes.

To help HCPs deliver the best possible advice, individuals with diabetes can be stratified into different groups according to the risk that fasting would impose. Different factors, such as the type of diabetes, level of glycaemic control, medication, presence of comorbidities and personal circumstances, can be used to assess individual risk. Medical experts and religious leaders have previously agreed on four categories of risk from very high to low [5, 6]. The *IDF-DAR Practical Guidelines* provides a new risk stratification strategy (presented in Chapter 4 – *Risk Stratification of Individuals with Diabetes before Ramadan*). Three risk categories are defined, based on the most up-to-date information from science and practice during Ramadan. This classification follows a more practical approach and has been approved by the Mofty of Egypt, the highest religious regulatory authority in Egypt. The religious opinion on fasting for the three categories is given in Chapter 5 (*Diabetes and Ramadan: A Medico-religious Perspective*). Also, within this chapter the importance for religious scholars to acquaint themselves with current recommendations so that they can give the best advice and support to patients with diabetes both before and during Ramadan is reviewed.

1.5 The importance of diabetes and Ramadan education

A cornerstone of Ramadan diabetes management is patient education, which should include information on risks, glucose monitoring, nutrition, exercise and medication [5, 7, 8]. Studies have shown that pre-Ramadan counselling reduces the incidence of hypoglycaemia, while recent reports from the UK and Pakistan show that effective education can be given by HCPs [8-10]. The importance of Ramadan-focused education is discussed in Chapter 6 (*Pre-Ramadan Education*). Pre-Ramadan education provides a platform to remind patients about the importance of diet and exercise, and that regular glucose monitoring is essential to avoid complications (while reassuring them that this does not invalidate the fast).

Education of physicians, especially in Muslim-minority countries, is also needed. A study in France found that among general practitioners, medical understanding of fasting in patients with diabetes during Ramadan was lacking and resulted in suboptimal advice being given [11]. In the US, a study reported that while 67% of patients with diabetes consulted HCPs before Ramadan, the majority did not receive relevant advice regarding risks, breaking the fast, diet, exercise or medications [12]. A practical guide of what should be covered and disseminated to patients is provided in Chapter 6.

1.6 Differences in Ramadan fasting practices across the world: consequences for individuals with diabetes

Nutrition therapy plays a vital role in diabetes management, and an individual's religion and culture should be considered when preparing their diet plan [13]. It is recommended that the diet of a person with diabetes during Ramadan should be comparable with that followed for the rest of the year [5, 8, 14]. However, Ramadan can result in an extra burden of calories. Iftar, the meal taken when the fast is broken at sunset, often turns into a celebration, with huge volumes of food laden with sugar and carbohydrates. Regional variations exist in the timings of meals during Ramadan, and physicians need to understand regional and cultural differences to advise the patient accordingly. Because of the different foods traditionally eaten at iftar by different cultures, a well-trained dietician should be at the centre of the diabetes management and follow-up team.



Physicians need to understand regional and cultural differences to advise the patient accordingly

Regional and cultural differences are an important component of the Ramadan Nutrition Plan (RNP), a mobile and web-based application that aims to provide HCPs with information to help them individualise medical nutrition therapy for patients with diabetes during Ramadan. Example meal plans for different countries and regions are included in this app, along with country-specific best-practice recommendations. A full description of the RNP can be found in Chapter 7 (*Ramadan Nutrition Plan (RNP) for Patients with Diabetes*).

1.7 Optimising strategies for the management of diabetes during Ramadan

Many patients with diabetes choose to fast during Ramadan [4] and they should schedule a pre-Ramadan assessment with their HCP in order to discuss management of the condition while fasting. This will enable the physician to assess the risk, provide advice and produce an individualised treatment plan with the

patient. A recommended patient assessment flowchart can be found in Chapter 8 (*Management of Diabetes during Ramadan*). Patients with diabetes can be treated with a number of different agents from a range of therapeutic classes, with differing side effects and associated risks. Some of these medications will require dose or timing adjustments during Ramadan fasting in order to minimise the risk of complications. Generating optimised Ramadan-specific treatment regimens for each patient is essential if a physician is to offer the best possible care. Chapter 8 reviews the range of pharmacological agents used to treat diabetes and highlights any associated Ramadan data. Some of these medications do not require dose modification. For those that do, Ramadan-specific regimens are proposed.



Generating optimised Ramadan-specific treatment regimens for each patient is essential if a physician is to offer the best possible care

As already indicated, there is no one-plan-fits-all scenario, as each patient will have factors specific to them that will affect the treatment strategy. This is especially true for patients that are considered high risk with a high probability of harm if they fast during Ramadan. This includes patients with T1DM and pregnant women with diabetes, many of whom will decide to fast against medical and religious advice. Guidance on the management of these high risk populations, including dose adjustments to medication is given in Chapter 8.

1.8 Disseminating and implementing the guidelines

For the *IDF-DAR Practical Guidelines* on diabetes management to be effective it is necessary to understand what obstacles may hinder their uptake. Chapter 9 *(Identifying and Overcoming Barriers to Guideline Implementation)* looks at this issue and discusses strategies that may help to surmount these difficulties. Problems exist among the community and patients, as well as within the healthcare service. For example, encouraging patients to change their dietary habits during Ramadan can be challenging. One study has reported poor compliance to diet guidelines even after repetitive counselling [15]. HCPs, including pharmacists, need to be educated about Ramadan fasting and diabetes. The 2010 CREED study found wide variation in the consultation of guidelines by HCPs across different countries, highlighting the need to disseminate this information more widely, particularly in Muslim-minority countries [1]. Implementation of guidance relies on the education of all those involved: religious leaders, HCPs, patients and the community.



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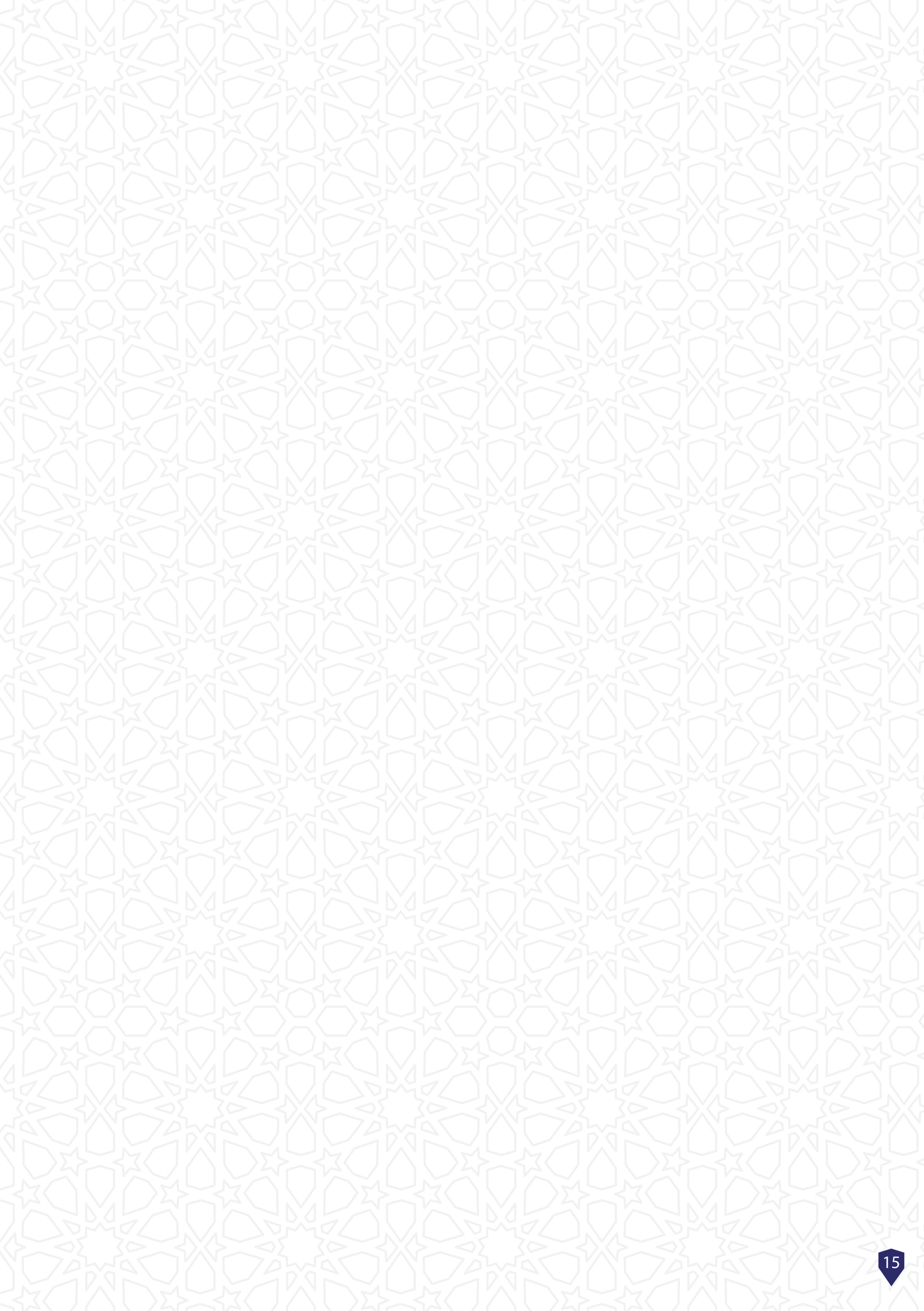
Embracing and utilising advances in technology may be one way to improve accessibility to information about management of diabetes during Ramadan, especially for people in remote regions. The mDiabetes project is one such initiative. Diabetes and Ramadan-related information is sent in text messages to enrolled individuals in Senegal (see Chapter 9) [16]. Since its launch in 2014 there has been a rapid rise in people registering to receive such information, and 100% of participants surveyed had requested to receive messages for the next Ramadan. This could prove to be an effective way of publicising and circulating up-to-date guidelines to a wider population.

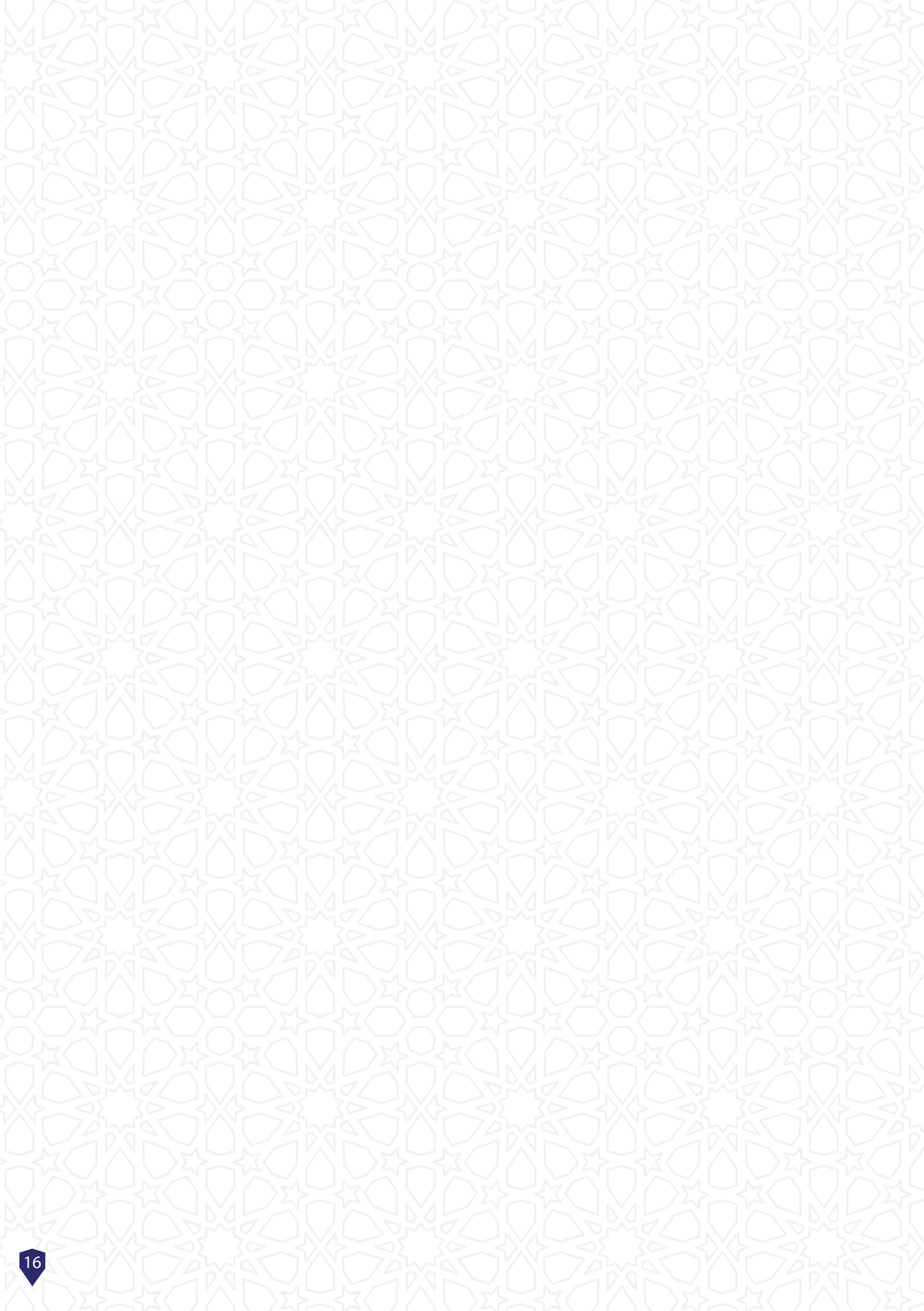
Summary

- With the worldwide prevalence of diabetes increasing, and the number of fasting Muslims set to rise, the importance of effective guidelines for the management of diabetes during Ramadan fasting is clear.
- There is a paucity of evidence-based medicine in the field of diabetes management during Ramadan. Indeed, many recommendations are based on expert opinion rather than clinical evidence.
- The *IDF-DAR Practical Guidelines* provide HCPs with both background and practical information, as well as management recommendations to optimise the care delivered to patients with diabetes who plan to fast during Ramadan.
- Pre-Ramadan education has been shown to reduce the incidence of hypoglycaemia. However, guidance given by medical professionals, particularly in Muslim-minority countries, may be suboptimal.
- Different medications to treat diabetes have varying levels of hypoglycaemic risk, and Ramadan-specific treatment regimens including dose and/or timing adjustments should be produced for each patient.
- Implementation of guidelines requires effective communication with, and education of all those involved, including patients, HCPs, religious leaders, and the wider community.
- Education, communication and accessibility are all critical to the success of the guidance provided in this document.

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Chapter 2. Epidemiology of Diabetes and Ramadan Fasting

Abdul Jabbar

2.1 The global impact of diabetes

The prevalence of diabetes has been increasing throughout the world over recent decades and the trend is set to continue [1, 2]. Estimates for 2015 indicated that there were approximately 415 million people with diabetes in the world, which could rise to 642 million in 2040; a 55% increase [1]. In 2015, 5 million deaths were caused by diabetes, with all nations suffering the impact of this epidemic [1]. The worldwide financial burden of diabetes is also vast, consuming 11.6% of total global health spending in 2015 (USD 673 billion) [1].



There are at least 415 million people living with diabetes throughout the world

The countries with the highest number of adults with diabetes in 2015 were China, India and the United States of America, with three Muslim-majority countries (Egypt, Indonesia and Bangladesh) being in the top 10. (***Table 1***) [1, 3].

Table 1. Top 10 countries/territories for number of adults with diabetes [1, 3]

Country/territory	Number of adults with diabetes (2015)	Muslim population (2010, %)
China	109.6 million	1.8
India	69.2 million	14.4
United States of America	29.3 million	0.9
Brazil	14.3 million	<0.1
Russian Federation	12.1 million	10.0
Mexico	11.5 million	<0.1
Indonesia	10.0 million	87.2
Egypt	7.8 million	94.9
Japan	7.2 million	0.2
Bangladesh	7.1 million	89.8

Prevalence rates in many countries in the Middle East and North Africa are well above the average global prevalence of 8.8%, and the region as a whole has the second-highest comparative prevalence of diabetes (10.7%) [1]. Diabetes accounted for approximately 342,000 adult deaths in the Middle East and North Africa in 2015, and more than half of these deaths were in those aged less than 60 years [1].

The Middle East and North Africa region also has a high and growing Muslim population [4]. Muslims comprise almost a quarter of the world's population, with nearly 1.6 billion followers of Islam worldwide as of 2010 [4]. The worldwide Muslim population is projected to increase by 73% by 2050, which will make Islam the fastest-growing world religion over the next four decades [4]. Most Muslim-majority countries are in less-developed regions of the world, and developing countries are disproportionately affected by diabetes [1, 2, 5]. Currently, 75% of people with diabetes live in low- and middle-income countries [1]. As a result of rapid modernisation, the demographic patterns in developing Islamic countries are changing substantially [1, 2]. Future generations will see increases in life expectancy and urbanisation, and a reduction in the infectious disease burden, all of which will contribute to an increase in diabetes prevalence in these regions (***Figure 1***) [2]. Moreover, dramatic development changes are already having a negative impact on lifestyle in these regions, such as increasing the levels of poor-quality nutrition and sedentary behaviour, facilitating weight gain that in turn increases the risk of diabetes [6, 7]. Smoking, another diabetes risk factor, is also a growing problem in low- and middle-income countries [8, 9].

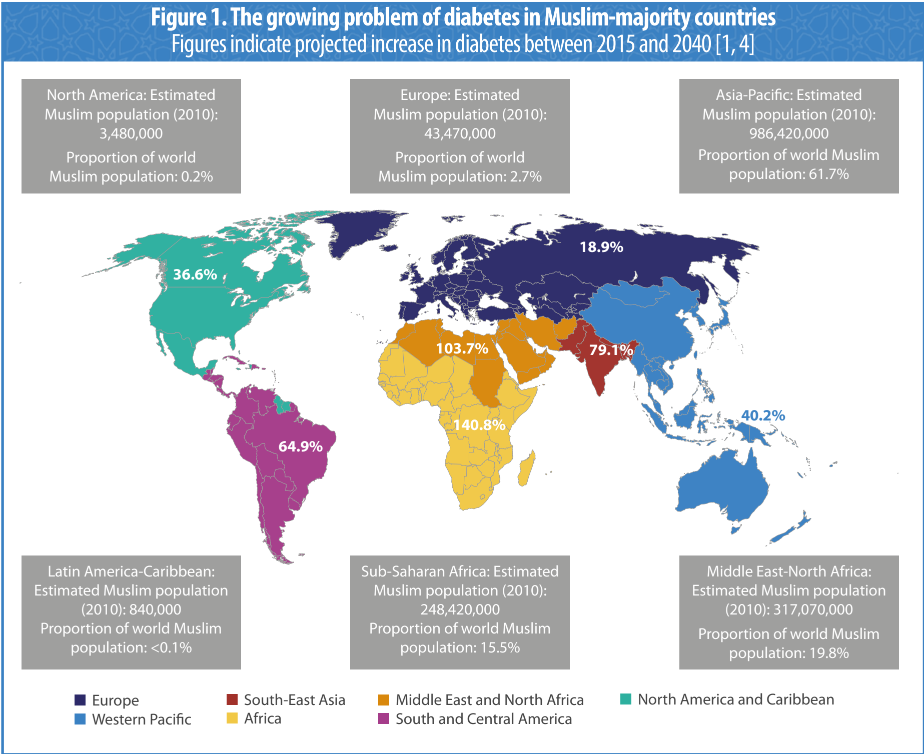


Figure 1. The growing problem of diabetes in Muslim-majority countries
Figures indicate projected increase in diabetes between 2015 and 2040 [1, 4]

Although the increase in diabetes in other regions, such as Europe and North America is predicted to be less pronounced, it is important to note that diabetes prevalence may vary between communities within the same country. For example, a study in the UK found the age-standardised prevalence of type 2 diabetes (T2DM) in South Asians to be almost four times higher than for non-South Asians [10]. In this study, two of the three countries of ancestral origin classified as South Asian were Muslim-majority countries (Pakistan and Bangladesh) [10]. Patients with diabetes who belong to ethnic minorities in the UK and in North America have been found to be at higher risk of developing diabetes-related complications [11].

2.2 Diabetes and Ramadan

Ramadan is a holy month for Muslims and, as one of the five pillars of Islam, fasting during this time is prescribed. The month lasts for 29–30 days, during which time the consumption of food and drink, as well as oral and injected medications, is forbidden between dawn and dusk. Depending on the season and geographic location, each period of fasting may last for up to 20 hours. Fasting is mandatory for all Muslim adults, with certain groups exempted, such as those who are suffering with illness – this may include some individuals with diabetes. Because of the metabolic nature of the disease, patients with diabetes are at particular risk of complications from marked changes in food and fluid intake. Potential health hazards include hypoglycaemia, hyperglycaemia, dehydration and acute metabolic complications such as diabetic ketoacidosis (DKA) [12]. Despite being exempt, many people with diabetes do participate in fasting during Ramadan. It is important that the decision about whether to fast is made on an individual basis in consultation with the patient's treating physician, taking into account the severity of illness and the level of risk involved [12]. These topics are considered in more detail in other chapters.

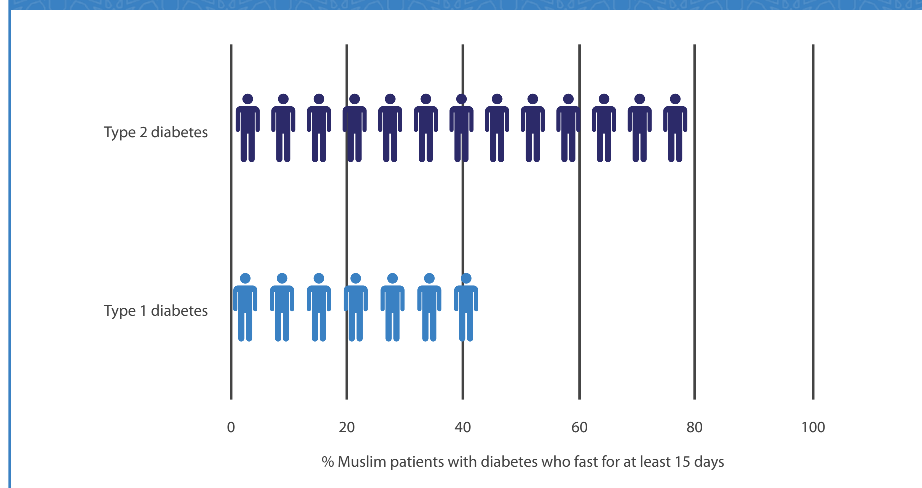
Fasting during Ramadan may provide enduring benefits. Indeed, Ramadan can provide an opportunity for a better lifestyle, facilitating weight loss and smoking cessation [13]. For patients with diabetes who choose to fast, Ramadan may help to strengthen the therapeutic alliance between patient and physician, and may provide an opportunity to improve diabetes management, with a focus on self-care and the regulation of medication and meal timing.

2.3 The epidemiology of diabetes and Ramadan fasting

In the landmark Epidemiology of Diabetes and Ramadan (EPIDIAR) study, information was collected from 12,243 Muslim people living with diabetes across 13 countries in 2001 [14]. The population was mainly urban (80%), with a mean age of 31 and 54 years for type 1 diabetes (T1DM) and T2DM, respectively [14]. Only 67% of patients with T1DM and 37% of patients with T2DM were self-monitoring

their blood glucose levels [14]. The study found that 42.8% of patients with T1DM and 78.7% of those with T2DM reported fasting for at least 15 days during Ramadan (***Figure 2***) [14]. Combining EPIDIAR data with the most recent estimates for the global Muslim population and global diabetes prevalence suggests that there are 148 million Muslims with diabetes across the world, of whom over 116 million may fast during Ramadan.

Figure 2. Up to 79% of Muslims with diabetes fast for at least 15 days during Ramadan [14]



Approximately half of the overall EPIDIAR study population did not change their lifestyle during Ramadan, including physical activity levels, sleep duration and food, fluid and sugar intake [14]. Recommendations from treating physicians were provided to 68% of patients with T1DM and 62% of patients with T2DM, and the majority of patients did not change their medication dose [14]. The number of severe hypoglycaemic episodes per patient per month was significantly higher during Ramadan than during the preceding year for all patients [14]. A relationship was observed between the incidence of severe hypoglycaemia and a change in medication dose; 38.4% and 55.3% of patients reporting severe hypoglycaemia had changed their oral anti-diabetic drug (OAD) or insulin dose respectively, compared with 19.7% and 36.7% of those without severe hypoglycaemia [14]. The number of hyperglycaemic episodes was also significantly higher during Ramadan for patients with T2DM [14]. The EPIDIAR study highlighted the various challenges that arise during Ramadan fasting for patients with diabetes and their healthcare professionals (HCPs). It also revealed a number of opportunities to improve the management of diabetes during this holy month, such as increasing the dissemination of fasting guidelines and the provision of patient education (pre-Ramadan counselling).

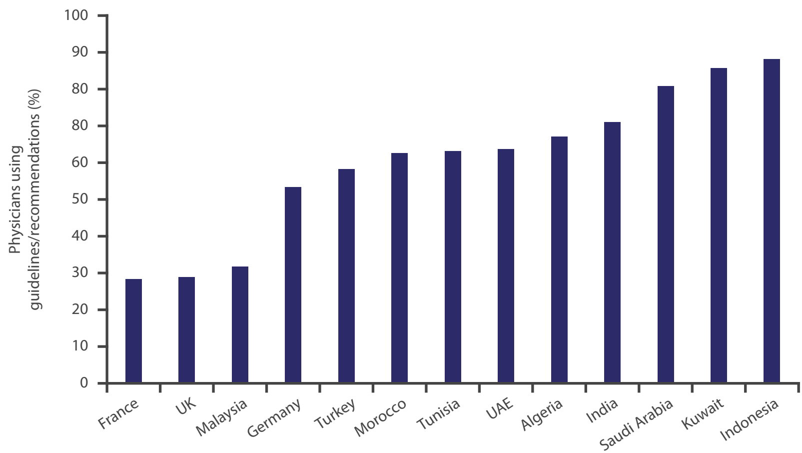
Indeed, since the publication of the EPIDIAR study, several recommendations for the management of diabetes during Ramadan have been developed, along with educational programmes [12, 15-17].



Estimates suggest that there are 148 million Muslims with diabetes worldwide

Just over a decade after the publication of the EPIDIAR study, the multi-country, retrospective, observational study of the management and outcomes of patients with T2DM during Ramadan in 2010 (CREED) was published [18]. A total of 508 physicians across 13 countries were selected to participate in the study. Participants were invited to enrol patients with T1DM, T2DM or gestational diabetes aged ≥18 years, who fasted for any period of time during Ramadan 2010 [18]. A total of 3,777 patients were enrolled, providing 3,394 evaluable cases, and data were reported for a subset of 3,250 patients with T2DM [18]. Among the physicians evaluated, 96.2% had provided advice to fasting patients [18]. Guidelines or recommendations for the management of diabetes during Ramadan were used by 62.6% of physicians, with notable inter-country differences (***Figure 3***) [18]. The recommendations developed in collaboration with the American Diabetes Association (ADA) were the most commonly used set of management guidelines or recommendations [18].
For each patient participating in the study, physicians were asked to assess the risk of adverse events using the ADA recommendations. Physicians reported that 33.3% of

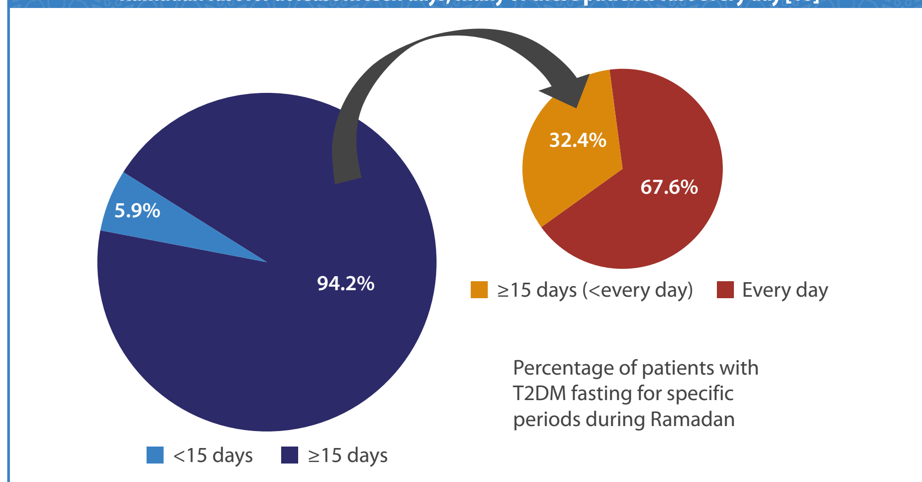
Figure 3. There is variation between countries in the use of guidelines or recommendations by physicians for the management of T2DM in patients who fast during Ramadan [18]



T2DM, type 2 diabetes mellitus; UAE, United Arab Emirates; UK, United Kingdom

patients were at low risk and 31.4% were at moderate risk, with wide variability between countries regarding the percentage of patients stratified to different levels of risk [18]. Of the patients evaluated, 94.2% reported fasting for at least 15 days during Ramadan and 63.6% of patients fasted every day during the month (***Figure 4***) [18]. These data therefore indicate that many patients who are considered to be at high or very high risk of adverse events still fast during Ramadan. This is despite the ADA recommendation that those at high risk should be advised against prolonged fasting [16].

Figure 4. According to the CREED study, 94.2% of Muslims with T2DM who fast during Ramadan fast for at least fifteen days; many of these patients fast every day [18]



The proportion of patients fasting for at least 15 days was fairly consistent across countries included in the study, being greater than 90% for 10 of the 13 countries evaluated [18]. The proportion of patients fasting every day was more varied, being highest in Algeria (83.5%), United Arab Emirates (78.8%) and Saudi Arabia (78%), and lowest in Morocco (22.9%), despite 95.6% of Moroccan patients in the study choosing to fast for at least 15 days [18]. The mean number of fasting days was 27, the same as in the EPIDIAR study [14, 18]. During Ramadan, most patients (64.1%) consumed just two meals per day [18]. There are other times during the year when Muslims may voluntarily fast and the CREED study reported that 29.9% of patients evaluated also fasted outside of Ramadan (ranging from 8% in India to 46% in Malaysia) [18]. Indeed, the ADA recommendations for management of diabetes during Ramadan were updated in 2010 to reflect the requirement for awareness of voluntary fasting throughout the year [15].



Nearly 30% of Muslims with diabetes who fast during Ramadan also fast at other times of the year

The majority of patients in the CREED study were receiving OAD regimens (76.6%) before Ramadan. A change in diabetes regimen in preparation for Ramadan was reported for a total of 39.3% of patients [18]. Frequency of administration (74.8%) was changed more frequently than was total daily dose (36.9%) or the drug itself (defined as a drug discontinuation, addition or switch; 20.4%) [18]. A change in frequency of administration was more common regardless of whether the patient was receiving oral or injectable therapy [18]. During Ramadan, at least one episode of hypoglycaemia was reported by 8.8% of patients with T2DM, compared with 5.4% before Ramadan; 47.8% of hypoglycaemic episodes necessitated cessation of the fast [18]. This hypoglycaemia rate is in line with that observed in a prospective observational study in Pakistan, in which patients received education regarding drug dosage and timing alteration, glucose monitoring and other lifestyle modifications [19]. However, other studies have reported much higher rates of hypoglycaemia during Ramadan (up to 41.7% for patients treated with sulphonylureas) [20, 21]. Such discrepancies may reflect differing levels of patient education and medication management across regions. Indeed, Ramadan-focused education has been shown to be beneficial in reducing the incidence of hypoglycaemia [22, 23].

In the CREED study, 96.2% of physicians reported giving advice to patients who fasted during Ramadan. In contrast, only 62% of patients with T2DM were provided with recommendations about fasting during this month in the EPIDIAR study [14, 18]. The EPIDIAR and CREED studies have notable differences including study design, the number of cases evaluated and the countries studied, making comparisons between the studies problematic. However, this marked increase in advice may reflect a change in physicians' practice as a result of guidelines becoming available, such as those developed in collaboration with the ADA.

The CREED study did not take into account those patients who did not visit their HCP in the lead up to Ramadan, and there are many patients with diabetes who do not receive specialised advice regarding fasting. Moreover, there are 193 million cases of undiagnosed diabetes across the world [1]. Indeed, estimates for 2015 predict that over 40% of cases of diabetes in the Middle East and North Africa were undiagnosed [1]. Health resources across the region need to be redirected to manage the soaring diabetes prevalence, ensuring the provision of adequate education and care for patients and for those at risk of developing diabetes [1]. As the number of Muslims with diabetes continues to increase, it will be paramount to ensure that both HCPs and patients throughout the world are fully aware of the recommendations and best practice approaches to diabetes care for those choosing to fast during Ramadan.

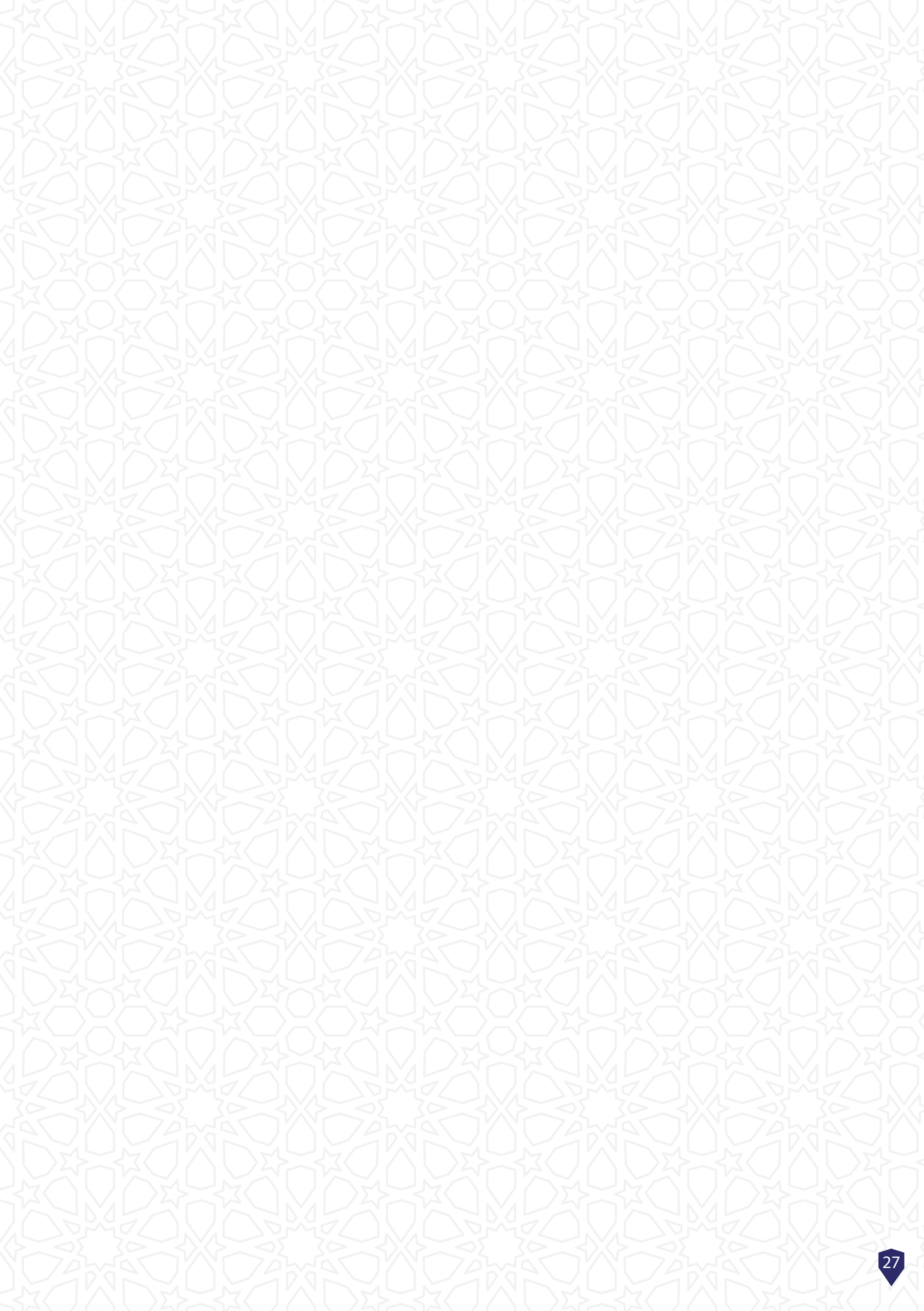
Summary

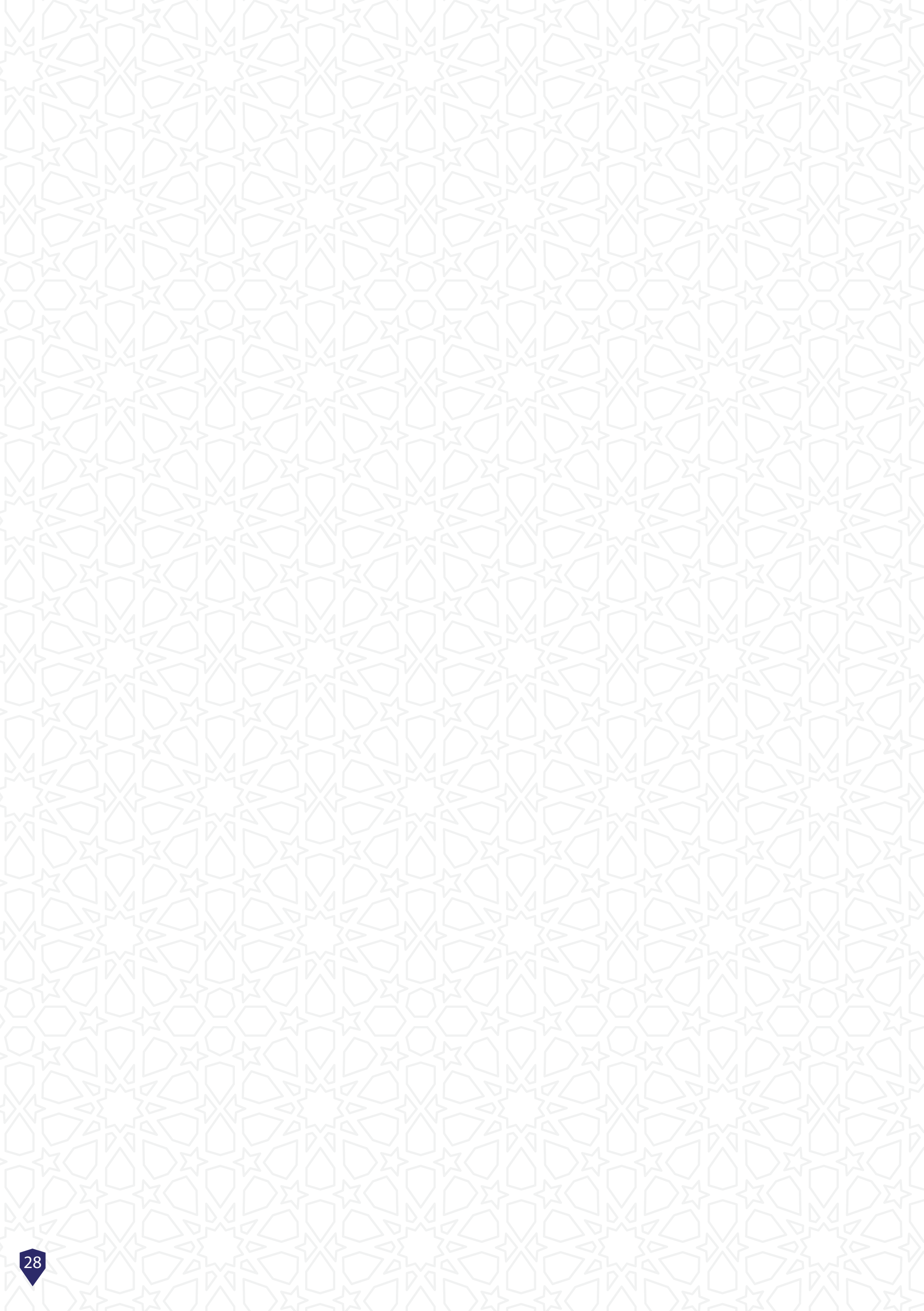
- The prevalence of diabetes is increasing throughout the world with estimates suggesting there will be 642 million people with diabetes by 2040; this increase is predicted to be particularly marked in Muslim-majority countries.
- Estimates suggest that there are 148 million Muslims with diabetes worldwide.
- Despite being exempt, the majority of Muslim patients with diabetes fast for at least half of the month of Ramadan. Many patients also fast at other times during the year.
- The provision of advice to patients with diabetes who fast during Ramadan appears to be increasing in line with the advent of guidelines for physicians, such as those developed in collaboration with the ADA.
- However, changes to diabetes regimens appear to be implemented in a low proportion of patients who fast during Ramadan.

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Chapter 3.
Physiology of Ramadan Fasting

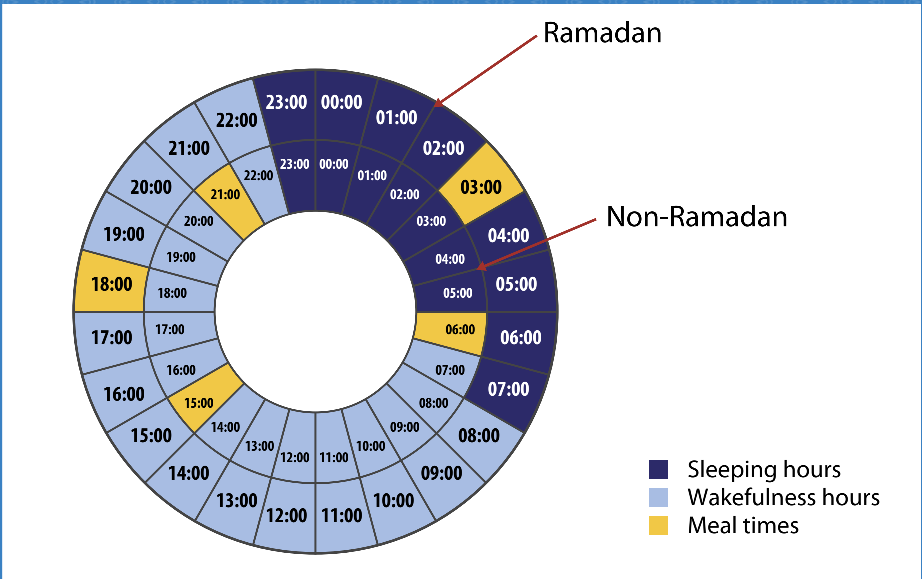
Wasim Hanif, Nader Lessan & Abdul Basit

3.1 Introduction

During Ramadan, fasting Muslims tend to avoid consulting their doctors [1]. It is therefore not surprising that potentially invasive studies have been difficult to conduct, leading to a relative paucity of direct evidence regarding the physiological effects of Ramadan fasting. Much of the insight gained to date has been extrapolated from studies involving subjects who have fasted for more than 48 hours. However, over the past few years some studies examining glucose metabolism, lipid profiles, circadian rhythms, sleep, and aspects of hormone physiology during Ramadan have been performed.

In fasting Muslims, the onset of Ramadan heralds a sudden shift in meal times, as well as in sleep and wakefulness patterns. ***Figure 1*** describes the typical sleeping/eating pattern of Muslims in many countries during Ramadan and in non-Ramadan periods. However, in other countries many Muslims may be awake most of the night and asleep after dawn. As no food or drink is taken during the hours of daylight, the time between meals during Ramadan is much longer than in other months of the year. This has important implications for physiology, with ensuing changes in the rhythm and magnitude of fluctuations in several homeostatic and endocrine processes. The duration of the fast impacts on the physiological changes that occur; this is of particular relevance when Ramadan falls during longer summer days, with higher latitudes experiencing the most hours of daylight.

Figure 1. Comparison of sleep and meal patterns during Ramadan and non-Ramadan periods



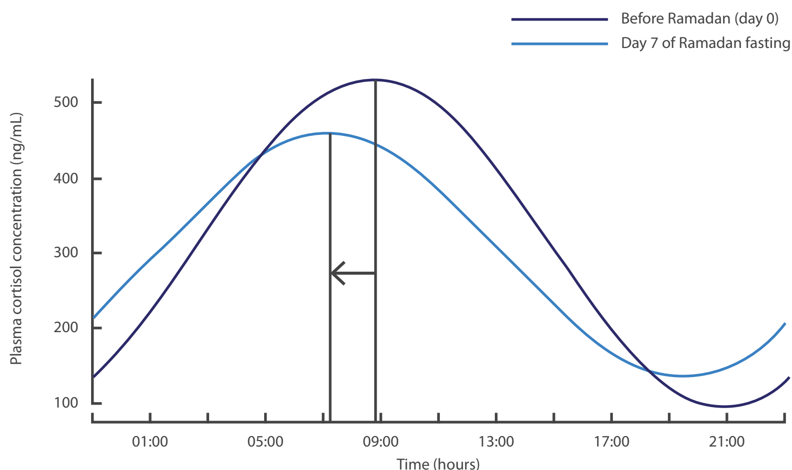
3.2 Ramadan physiology – fasting in the healthy individual

3.2.1 Changes in sleeping patterns and circadian rhythms during Ramadan

Sleeping patterns are often altered during Ramadan (***Figure 1***) [2, 3]. Typically, sleep is broken before dawn to enable Muslims to eat before fasting begins (suhoor). Many will return to sleep afterwards and wake for a second time to start the day. Some fasting Muslims may sleep in the afternoon. Following the evening meal (iftar), many will stay awake until midnight, or later. The impact of Ramadan on sleep includes decreased total sleep time, delayed sleep, decreased sleep period time, decreased rapid eye movement (REM) sleep duration, decreased proportion of REM sleep, and increased proportion of non-REM sleep [3, 4]. Sleep deprivation has been associated with decreased glucose tolerance [5], and the correlation between sleeping duration and insulin resistance has been a subject of renewed medical interest [6, 7]. However, the relevance of this to fasting during Ramadan is not yet known.

Changes to sleep and food intake impact on circadian rhythms; several changes have been noted, including changes in body temperature and cortisol levels [2-4, 8]. Compared with non-Ramadan periods, lower morning cortisol levels and higher evening cortisol levels have been observed during Ramadan [4, 8]. One study indicated a shift in the cortisol curve on day 7 of Ramadan (***Figure 2***) but on day 21 these changes had almost completely reverted to the pre-Ramadan profile [4]. Alterations in cortisol circadian rhythm may account, in part, for the feeling of lethargy felt by some Muslims during Ramadan.

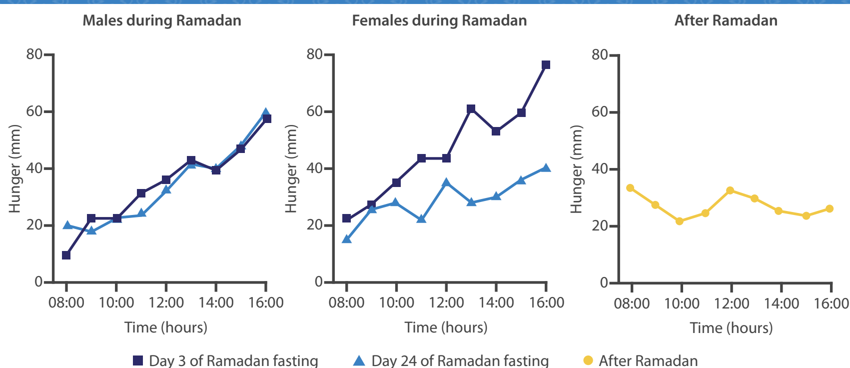
Figure 2. Changes in cortisol circadian rhythm during Ramadan. A shift in cortisol profile is seen on day 7. This reverts to near-baseline (non-Ramadan) values by day 21 [4]



3.2.2 Effects of Ramadan fasting on body weight in healthy subjects

Hunger–satiety cycles during Ramadan change in line with the shift in the timing of main meals, with the wider gap between meals intensifying feelings of hunger (***Figure 3***) [9]. This increase in hunger rating during fasting hours is seen in both sexes and is intense by iftar time. However, in females, some adaptation seems to occur, and by day 24 of Ramadan fasting, the hunger rating during fasting hours appears to reduce in intensity (***Figure 3***) [9].

Figure 3. Changes in hunger–satiety cycles during Ramadan. During fasting hours, there is a progressive rise in hunger rating which peaks just before iftar time*



Resisting the temptation to have a particularly large meal at iftar can be difficult and studies have reported that a large proportion of total daily caloric intake occurs at this time [10]. In some individuals a net energy excess can build up, leading to overall weight gain. However, this is not universal and indeed a meta-analysis of studies investigating the effects of Ramadan fasting on body weight reported a net weight loss among healthy fasting individuals [11]. A sub-analysis revealed a gender difference in weight change, with net weight loss observed in males and no weight change observed in females [11].

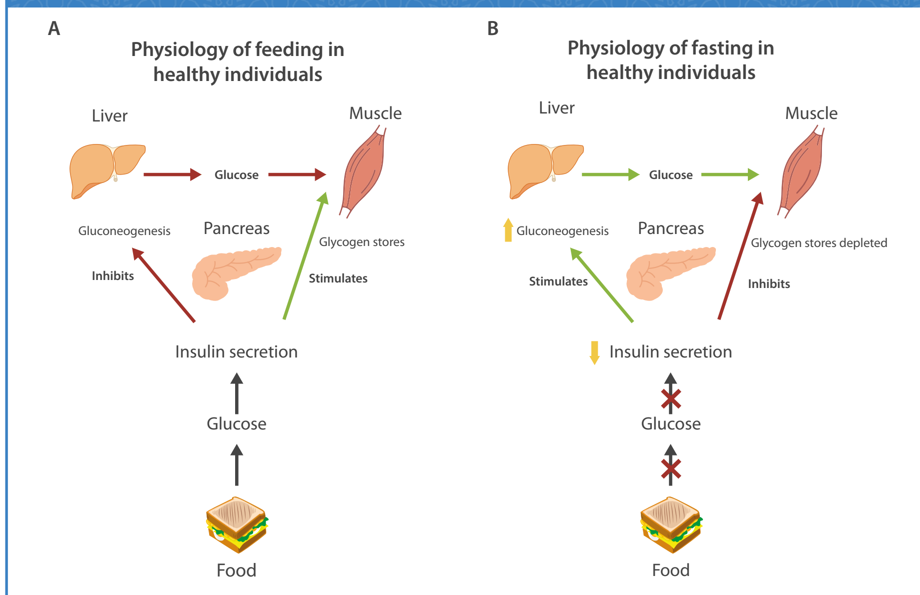


Body weight typically decreases or remains stable during Ramadan

3.2.3 Effects of fasting on glucose homeostasis in healthy individuals

In healthy individuals, increased glucose levels in the blood after eating stimulates insulin secretion, which triggers the liver and muscles to store glucose as glycogen (***Figure 4A***) [12].

Figure 4. Physiology of feeding and fasting in healthy individuals



During fasting, circulating glucose levels fall and insulin secretion is suppressed (***Figure 4B***) [12]. Glucagon and catecholamine secretion is increased, stimulating glycogenolysis and gluconeogenesis, which then leads to an increase in blood glucose level (***Figure 4B***) [12].



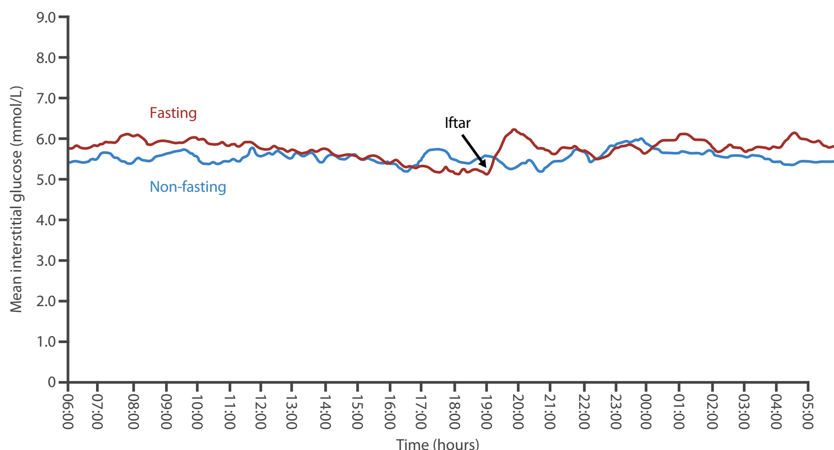
In a healthy individual, fasting causes the release of glucose from glycogen stores (glycogenolysis) and the formation of glucose from non-carbohydrate substrates (gluconeogenesis)

Liver glycogen can provide enough glucose for the brain and peripheral tissues for around 12 hours [13]. When glycogen stores are depleted and levels of insulin are low, fatty acids are released from adipocytes and oxidised to generate ketones, which can be used as fuel by many organs, preserving glucose for the brain and erythrocytes [13].

During Ramadan, each fasting period is often longer than 12 hours and may therefore be considered to be a state of intermittent glycogen depletion and repletion. In practice, most subjects who take their first meal at dawn are in a state of glycogen depletion by late afternoon, at which point ketogenesis occurs. Omission of suhoor leads to depletion of glycogen stores and ketosis much earlier in the fasting day.

Although fasting blood glucose levels have been shown to decrease during Ramadan [11, 14, 15], a recent continuous glucose monitoring (CGM) study observed a remarkable stability of blood glucose in seven healthy subjects during fasting hours, with no evidence of increased time spent in hypoglycaemia compared with non-Ramadan periods (***Figure 5***) [16]. This is despite reports of increased insulin resistance during Ramadan [8, 17, 18]. At iftar, a modest rise in interstitial glucose (and thus blood glucose) was seen, which remained within normal limits [16].

Figure 5. Mean continuous glucose monitoring (CGM) profiles from healthy subjects before and during Ramadan; there is a remarkable stability of blood glucose during fasting hours followed by a minimal rise in blood glucose at iftar*



*Reprinted from Diabetes Metab, Vol 41, Lessan et al, Glucose excursions and glycaemic control during Ramadan fasting in diabetic patients: Insights from continuous glucose monitoring (CGM), pp28-36, Copyright (2015), with permission from Elsevier [16]

3.2.4 Effects of fasting on other metabolic parameters in healthy individuals

Several studies have demonstrated Ramadan fasting to be associated with favourable effects on the lipid profile of healthy individuals [10, 19-21]. A meta-analysis, published in 2014 and involving 30 articles investigating the effect of Ramadan fasting on parameters including blood lipids, found no change overall in high density lipoprotein (HDL) or triglyceride (TG) levels, but large significant decreases in low density lipoprotein (LDL) levels [11]. There were however some differences in the effects of fasting on lipid profile between genders, with a significant increase in HDL in females, and a small significant decrease in TG levels in males after Ramadan [11].



Ramadan fasting is associated with favourable effects on lipid profile in healthy individuals

Ramadan fasting is also associated with changes in leptin and adiponectin. Leptin and adiponectin are hormones involved in the regulation of appetite, various metabolic pathways and insulin sensitivity [17]. In one study (n=23), morning levels of leptin were shown to increase during Ramadan compared with non-Ramadan periods [17]. In the same study, evening levels of growth hormone, which is known to affect insulin sensitivity, were found to decrease during Ramadan [17]. Leptin levels were also found to be altered during Ramadan in another small study (n=8) [22]. Although the circadian rhythm of leptin was unaffected, night-time levels of leptin were reduced compared with non-Ramadan periods [22].

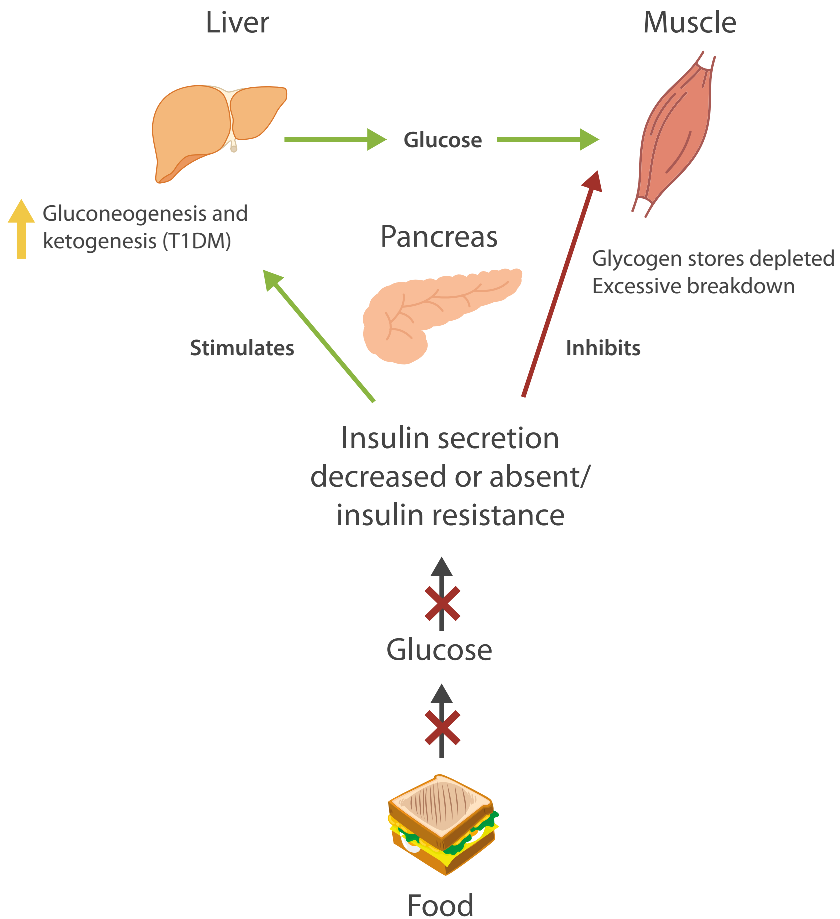
Adiponectin modulates glucose metabolism and high levels of adiponectin are associated with increased insulin sensitivity [23]. Adiponectin is also indirectly involved with inhibition of gluconeogenesis [23]. The effect of Ramadan fasting on adiponectin levels is unclear. One recent study observed a significant decrease in adiponectin in healthy males after 4 weeks of Ramadan fasting, and another reported decreased levels of adiponectin in the mornings during Ramadan [15, 17]. Conversely, a study involving healthy males with risk factors for type 2 diabetes (T2DM) reported a significant increase in adiponectin at the end of Ramadan [24].

Changes in leptin and adiponectin levels observed during Ramadan may be due to changes in meal and sleeping patterns, or due to the changes in cortisol circadian rhythm that have been reported during Ramadan [8].

3.3 Pathophysiology of fasting in patients with diabetes

3.3.1 Glycaemic control and glucose variability

In individuals with diabetes, glucose homeostasis is disturbed by both the underlying pathophysiology and the medications used to treat the condition. When fasting, insulin resistance/deficiency can lead to excessive glycogen breakdown and increased gluconeogenesis in patients with type 1 diabetes (T1DM) and T2DM; in addition, in T1DM, augmented ketogenesis can occur (***Figure 6***). As a result, the risks facing patients with diabetes are heightened during Ramadan. These include hypoglycaemia, hyperglycaemia, diabetic ketoacidosis, dehydration and thrombosis [13]. As well as fasting, feasting during Ramadan carries risks for those with diabetes.



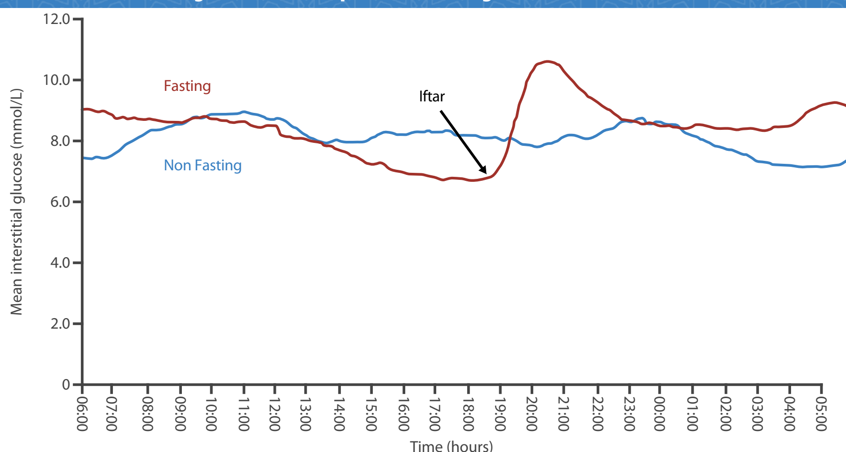
The landmark Epidemiology of Diabetes and Ramadan (EPIDIAR) study found that during Ramadan there was a 4.7-fold and 7.5-fold increase in the incidence of severe hypoglycaemic complications in patients with T1DM and T2DM, respectively, compared with non-Ramadan periods [25]. During the fast, patients with T1DM may fail to secrete adequate levels of glucagon in response to hypoglycaemia, leading to further decreases in blood glucose levels [13]. In addition, as a result of autonomic neuropathy, some patients with T1DM may have a defective adrenaline response and therefore an inadequate response to hypoglycaemia [26]. The incidence of severe hyperglycaemia was also found to be increased during Ramadan (3-fold and 5-fold in patients with T1DM and T2DM, respectively) [25].



Without suitable management, patients with diabetes are more likely to experience severe hypoglycaemia during Ramadan than in non-fasting periods

Over the last few years, CGM studies have been performed in patients with diabetes before and during Ramadan [16, 27-29]. One recently published study involving 50 patients with T2DM, and six patients with T1DM reported no significant differences in markers of glycaemic control between Ramadan and non-Ramadan periods [16]. There were also no significant differences in the number of high or low glucose excursions, or time spent in euglycaemia, hypoglycaemia, and hyperglycaemia [16]. However, major intra- and inter-individual variability in CGM profiles were observed. A rapid rise in glucose level after iftar (***Figure 7***) was seen; this is most probably due to the carbohydrate-rich meal at iftar, but other factors such as hormonal changes could also be involved [16]. Inappropriate timing and inadequate dosing of anti-diabetic medication may also be important contributors to this rise [16].

Figure 7. Mean continuous glucose monitoring (CGM) profiles from patients with diabetes before and during Ramadan. A rapid rise in blood glucose is seen at iftar time*



*Reprinted from Diabetes Metab, Vol 41, Lessan et al, Glucose excursions and glycaemic control during Ramadan fasting in diabetic patients: Insights from continuous glucose monitoring (CGM), pp28-36, Copyright (2015), with permission from Elsevier [16]

3.3.2 Other metabolic effects of Ramadan fasting in patients with diabetes

Effects on body weight

The EPIDIAR study showed that weight remained unchanged in the majority of patients with T1DM and T2DM (62.5% and 54.1%, respectively) at the end of Ramadan [25]. Other, smaller studies have reported either no effect on weight or weight loss in patients with diabetes during Ramadan [30].

Effects on lipid metabolism

While favourable changes in lipid profile have been seen in healthy subjects who fast during Ramadan, few studies have investigated changes in lipid profile in fasting patients with diabetes. In those studies that have been performed, both favourable and unfavourable changes have been reported such as reduced cardiovascular risk, slightly decreased total cholesterol and increased total LDL cholesterol [31-33].

Other effects of Ramadan fasting in patients with diabetes

Two key concerns for patients with diabetes who fast during Ramadan are dehydration and thrombosis. Dehydration may be compounded in hot climates or in individuals who undertake intensive physical labour, as well as by osmotic diuresis caused by hyperglycaemia. Dehydration can lead to hypotension and subsequent falls or other injuries [13]. According to a survey in Saudi Arabia, the incidence of retinal vein occlusion increased during Ramadan when almost 30% of all cases occurred, significantly more than in other months of the year. Dehydration was proposed to be a possible cause [34].

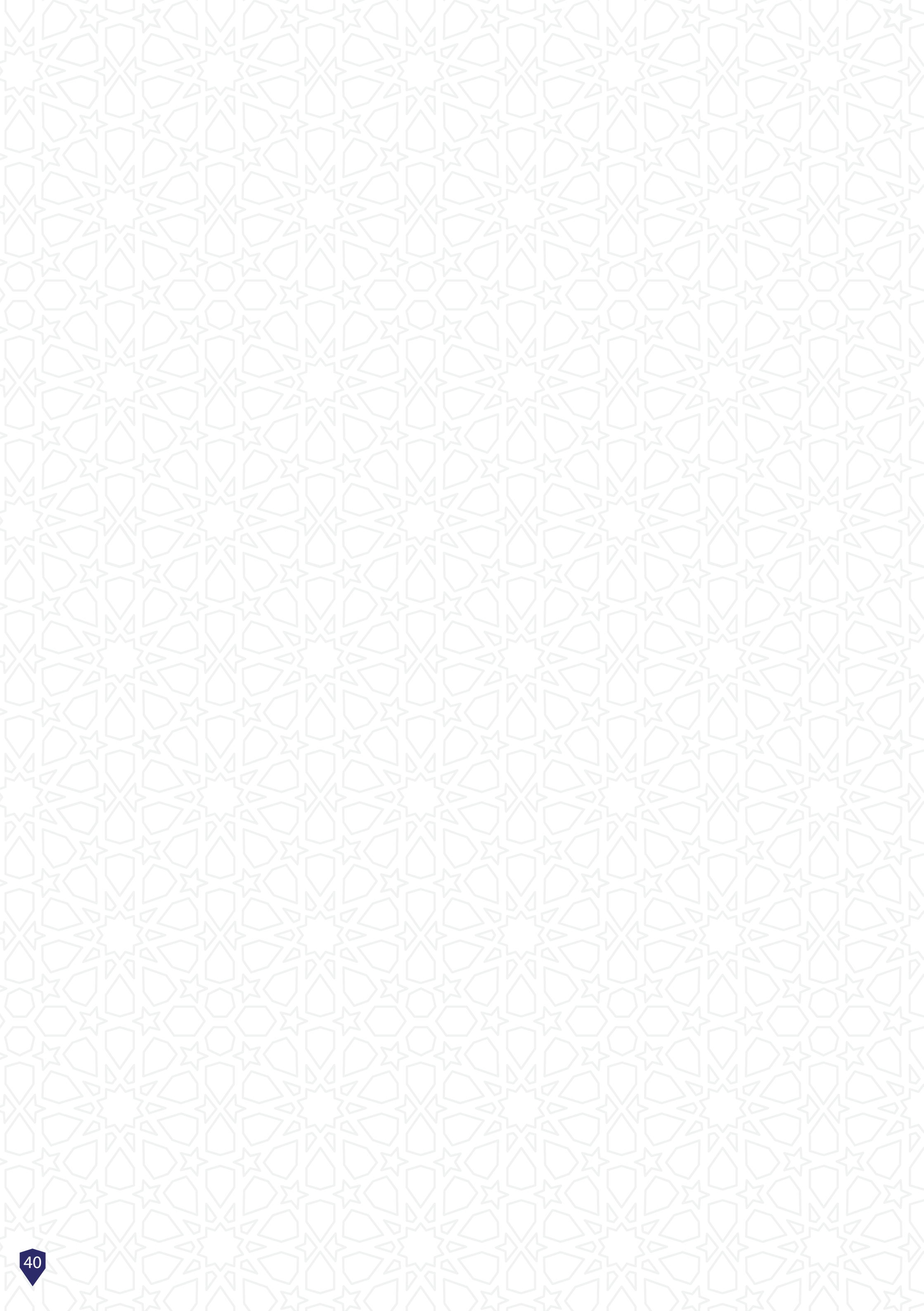
Summary

- The month of Ramadan can precipitate dramatic changes in meal schedule, sleep patterns and circadian rhythms.
- Ramadan fasting can be associated with favourable physiological changes among healthy individuals, such as decreased body weight and favourable changes in lipid profile.
- In patients with diabetes, however, Ramadan fasting can be associated with certain risks due to the pathophysiology that disrupts normal glucose homeostatic mechanisms.
- Therefore, patients with diabetes, and in particular those with T1DM, should seek medical advice before deciding to proceed with Ramadan fasting.

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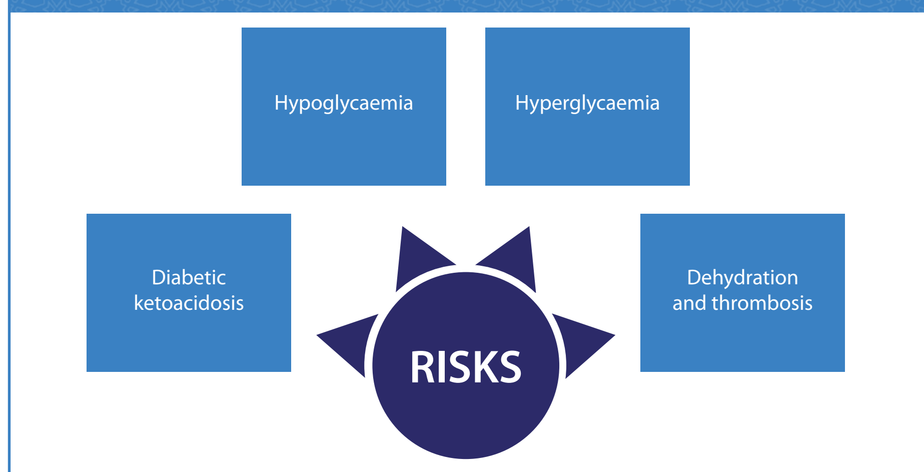
Chapter 4.
Risk Stratification of Individuals with Diabetes before Ramadan

Monira Al-Arouj, Abdullah Ben-Nakhi
& Mohamed Hassanein

4.1 Risks associated with fasting in people with diabetes

During Ramadan, the normal diet changes considerably and physical activity levels fall during the daytime compared with other times of the year. These changes can result in metabolic disturbances and also lead to alterations in the timing and doses of diabetes medication. Ramadan lasts for 29–30 days, and over the next few years will fall during the summer months in a majority of countries. As discussed in Chapter 3, Muslims with diabetes who choose to fast face a number of challenges. Key risks associated with fasting are shown in ***Figure 1*** [1]. Summer fasting periods last up to 20 hours per day and are often undertaken in hot and humid conditions which can exacerbate the risks. Dehydration, in particular, is a serious risk associated with fasting [2].

Figure 1. Key risks associated with fasting for patients with diabetes [1]

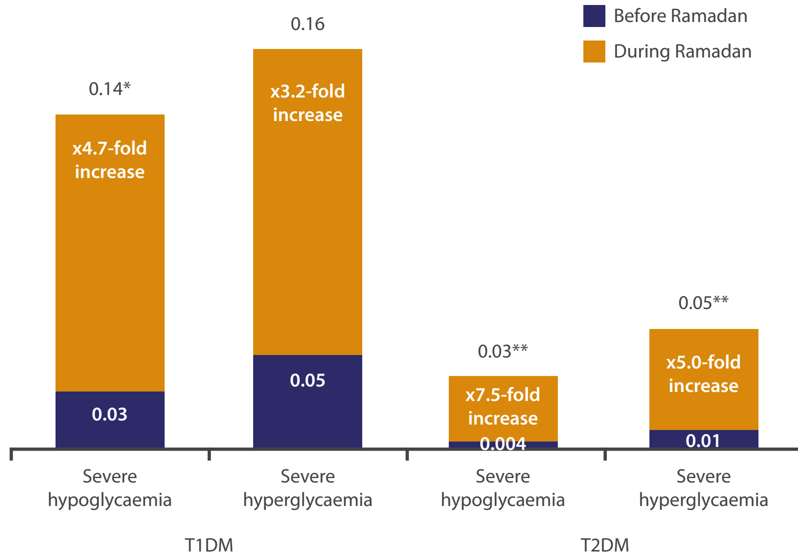


The major risks, hypoglycaemia and hyperglycaemia, are the same challenges that people with diabetes face on a daily basis; however, studies have shown that fasting may increase the occurrence of these events. In the EPIDIAR study (see Chapter 2 for details), higher rates of severe hypoglycaemia were recorded in people with type 1 or type 2 diabetes mellitus (T1DM/T2DM) during Ramadan compared with before Ramadan (4.7-fold or 7.5-fold increases, respectively) (***Figure 2***) [3]. A study in Pakistan, carried out by Ahmedani et al, found that of the 388 patients with diabetes who chose to fast, symptomatic hypoglycaemia was reported by 35.3% and 23.2% of patients with T1DM and T2DM, respectively [4]. Lower figures were observed in the CREED study, where only 8.8% of patients with T2DM reported a hypoglycaemic event; a majority of these episodes, however, required further assistance or breaking of the fast [5].



The major risks associated with fasting (hypoglycaemia and hyperglycaemia) are the same challenges that people with diabetes face on a daily basis; however, studies have shown that fasting may increase the risk of these events occurring

Figure 2. EPIDIAR study: mean numbers of severe glycaemic events/month during Ramadan compared with before Ramadan [3]



*p<0.05; **p<0.0001
T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus

Higher hyperglycaemia rates have also been reported during Ramadan. Among patients with T2DM in the EPIDIAR study, rates increased 5.0-fold for hyperglycaemia with or without diabetic ketoacidosis (DKA) [3]. In the Ahmedani study, symptomatic hyperglycaemia was observed in 33.3% and 15.4% of patients with T1DM and T2DM, respectively [4]. In another study, performed in the United Arab Emirates, the rate and duration of hospital admission for DKA during Ramadan and the following month (Shawal) were compared. Although there were no significant differences in DKA rates between Ramadan and Shawal, the observed incidence for the two months was higher than the average monthly rate. The mean length of hospitalisation was significantly longer for patients admitted during Ramadan than for those admitted during Shawal [6]. Most of the patients admitted (75%) had not received any guidance on diabetes management during Ramadan.

Type of anti-diabetic medication can influence hypoglycaemic risk during fasting (see Chapter 8 for details and recommendations). In addition, meals eaten during

Ramadan are often large and contain fried and sugary food which can have an impact on blood glucose control [2]. Fluctuations in blood glucose levels, particularly postprandial hyperglycaemia, have been linked with oxidative stress and platelet activation as well as the development of cardiovascular disease in people with diabetes [7-9].



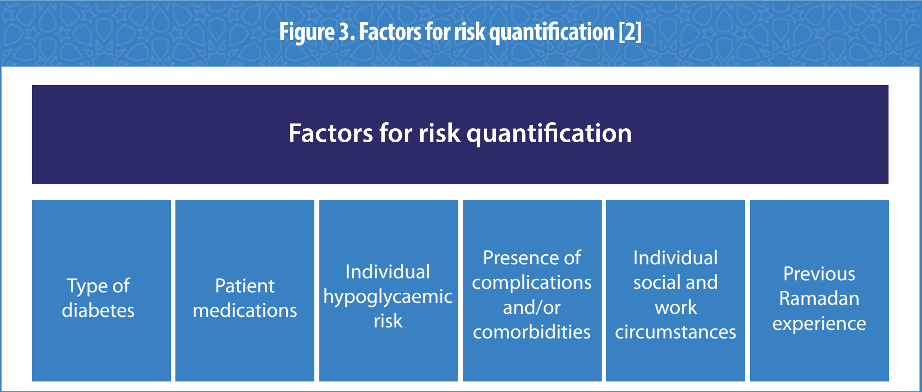
Healthcare professionals must be conscious of the risks associated with fasting and should quantify and stratify the risks for every patient individually in order to provide the best possible care

Taking all these risks into account it is easy to see why religious regulations, as well as medical recommendations, allow exemption from fasting for some people with diabetes [1, 10, 11]. However, for many such individuals, fasting is a deeply spiritual experience and they will insist on taking part, perhaps unaware of the risks they are taking. Healthcare professionals (HCPs) caring for these patients must be conscious of the potential dangers and should quantify and stratify the risks for every patient individually in order to provide the best possible care.

4.2 Risk quantification

As noted in Chapter 2, it has been estimated that more than 100 million people with diabetes fast during Ramadan [5] and this number will continue to grow. The latest predictions from the International Diabetes Federation (IDF) suggest that in the Middle East and North Africa region alone, the number of people with diabetes will more than double from 35.4 million to 72.1 million over the next 25 years, with a similar rise expected in Africa and South-East Asia [12]. However, it should be noted that a majority of the Muslim diabetes population are able to fast, as shown by the CREED study where 63.6% were able to complete the full month of Ramadan fasting [5]. Safety of fasting is paramount and various elements should be considered when quantifying the risk for such patients (***Figure 3***).

Figure 3. Factors for risk quantification [2]



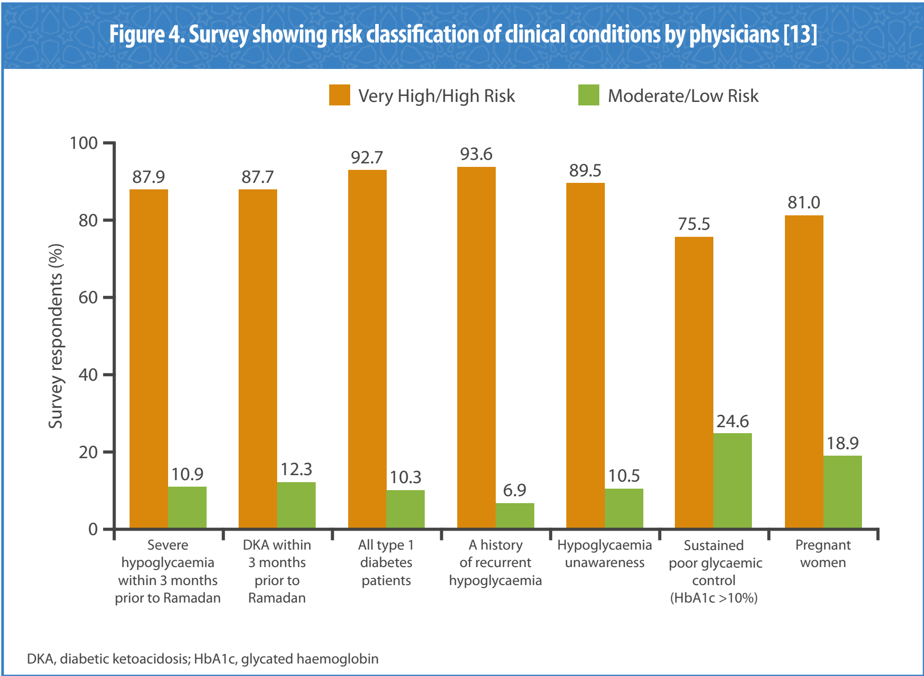
This assessment exercise must be carried out on an individual basis for each patient looking to fast during Ramadan, and the care given must be personalised according to the patient's specific circumstances.

4.3 Risk stratification

The 2005 American Diabetes Association (ADA) recommendations for management of diabetes during Ramadan and its 2010 update categorised people with diabetes into four risk groups – very high risk, high risk, moderate risk and low risk [1, 10]. These risk categories have been endorsed by the Islamic Organization for Medical Sciences and the International Islamic Fiqh Academy, who published a decree accepting and approving the ADA's risk categories and outlined recommendations for who should not fast based on the probability of harm [11].

In the CREED study, 62.6% of physicians referred to guidelines for the management of fasting. Of these, 39.0% reported using the ADA 2005 recommendations and 41.2% consulted the 2010 guidelines [5]. A recent study involving nearly 200 physicians mainly from the Middle East and North Africa revealed that the vast majority stratified patients in accordance with the categories defined in the ADA 2005 and 2010 recommendations. These findings suggest that these recommendations are in line with real-world practice (***Figure 4***) [13].

Figure 4. Survey showing risk classification of clinical conditions by physicians [13]



DKA, diabetic ketoacidosis; HbA1c, glycated haemoglobin

Surprisingly, the numbers of days fasted by the highest and the lowest risk group only varied by 3 days, indicating that either these risk categories are not efficiently applied by HCPs or that people with diabetes are ignoring these medical recommendations despite the fact that they are recognised by religious leaders [5]. Hence, there is a clear need to reconsider the various risk categories and to provide a level of flexibility that would help the individual with diabetes and their HCPs to make a decision regarding fasting during Ramadan.

Table 1 summarises the new risk categorisations defined by the IDF and Diabetes and Ramadan International Alliance (IDF-DAR). Patients should not fast if the probability of harm is high. However, if high risk patients choose to fast, against medical advice, then conditions that need to be fulfilled by these individuals are included in the recommendations. It should be remembered that although medical-based evidence is scarce in this field, safety for the person with diabetes is of the utmost importance. Indeed, this approach matches the essence of the religious regulations of Islam and has been approved by the Mofty of Egypt, the highest religious regulatory authority in Egypt (see Chapter 5 for further details).

Patients who are in the two highest categories of IDF-DAR risk should not fast; however, as previously mentioned, many of these patients will choose to do so and this must be respected. This important personal decision should clearly be made in light of guidelines for religious exemptions and after consideration of the associated risks in consultation with HCPs. Patients who insist on fasting need to be aware of the risks associated with fasting, and of techniques to decrease this risk. It is also worth highlighting that the initial risk assessment could change in time according to a number of factors. For example, a person with T2DM with poor glycaemic control is considered to be at high risk. If control improves pre-Ramadan and the choice of treatment does not include multiple insulin injections, then such a person would be considered to be at moderate risk.



Patients who are in the two highest categories of risk are advised not to fast; however, many of these patients will choose to do so and this must be respected

Once a patient has been made aware of the risks associated with fasting, they should be provided with an individualised management plan and be advised on the measures they can take to minimise these risks. This includes attending a pre-Ramadan assessment, regular self-monitoring of blood glucose levels (SMBG), structured education, medication adjustments and nutritional and exercise advice [10].

Table 1. IDF-DAR risk categories for patients with diabetes who fast during Ramadan

Risk category	Patient characteristics	Comments
Category 1: very high risk	One or more of the following: • Severe hypoglycaemia within the 3 months prior to Ramadan • DKA within the 3 months prior to Ramadan • Hyperosmolar hyperglycaemic coma within the 3 months prior to Ramadan • History of recurrent hypoglycaemia • History of hypoglycaemia unawareness • Poorly controlled T1DM • Acute illness • Pregnancy in pre-existing diabetes, or GDM treated with insulin or SUs • Chronic dialysis or CKD stage 4 & 5 • Advanced macrovascular complications • Old age with ill health	If patients insist on fasting then they should: • Receive structured education • Be followed by a qualified diabetes team • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations • Be prepared to break the fast in case of hypo- or hyperglycaemia • Be prepared to stop the fast in case of frequent hypo- or hyperglycaemia or worsening of other related medical conditions
Category 2: high risk	One or more of the following: • T2DM with sustained poor glycaemic control* • Well-controlled T1DM • Well-controlled T2DM on MDI or mixed insulin • Pregnant T2DM or GDM controlled by diet only or metformin • CKD stage 3 • Stable macrovascular complications • Patients with comorbid conditions that present additional risk factors • People with diabetes performing intense physical labour • Treatment with drugs that may affect cognitive function	
Category 3: moderate/low risk	• Well-controlled T2DM treated with one or more of the following: – Lifestyle therapy – Metformin – Acarbose – Thiazolidinediones – Second-generation SUs – Incretin-based therapy – SGLT2 inhibitors – Basal insulin	Patients who fast should: • Receive structured education • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations

*The level of glycaemic control is to be agreed upon between doctor and patient according to a multitude of factors

CKD, chronic kidney disease; DAR, Diabetes and Ramadan International Alliance; DKA, diabetic ketoacidosis; GDM, gestational diabetes mellitus; IDF, International Diabetes Federation; MDI, multiple dose insulin; SGLT2, sodium-glucose co-transporter-2; SMBG, self-monitoring of blood glucose; SU; sulphonylurea; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus

The importance of risk stratification is reflected in the central role it has taken in two recently proposed management strategies – the PRE-approach (Presentation, Risk stratification, Education), and the 5 R's (Respect, Risk stratification, Revision of therapy, Regular follow-up, Reappraisal of strategy) [14, 15].

4.4 Special populations

4.4.1 Type 1 diabetes

People with T1DM will be advised not to fast because of the risks of severe complications. However, recent studies involving young adults suggest that if the patient is stable, otherwise healthy, has good hypoglycaemic awareness and complies with their individualised management plan under medical supervision, then many of these patients can fast safely [16]. One study involving 33 adolescent children with T1DM found that 60.6% completed the fast without any serious problems [17]. These children and their caregivers were given intensive training and education on insulin adjustment, SMBG, and nutrition before Ramadan and were closely monitored during the month-long fast. In total, five cases of mild hypoglycaemia and no cases of DKA were recorded [17]. Another study involving 21 adolescents with T1DM also found that a majority (76%) could fast for at least 25 days [18]. However, the use of continuous glucose monitoring equipment in this study demonstrated that blood glucose levels fluctuated and some episodes of hypoglycaemia went unrecognised, suggesting that regular SMBG during fasting is vital. The findings also highlighted the importance of thorough attention to hypoglycaemia unawareness in these circumstances [18].

While the results of these studies are encouraging, they cannot be generalised to all people with T1DM. Strategies to ensure safety of individuals with T1DM who choose to fast include: Ramadan-focused medical education, pre-Ramadan medical assessment including robust assessment of hypoglycaemia awareness, following a healthy diet and physical activity pattern, modification of insulin regimen, and frequent SMBG or continuous glucose monitoring [16].

4.4.2 The elderly

Many older people have enjoyed fasting during Ramadan for many years and they should not be categorised as high risk based on a specific age but rather on health status and their social circumstances. Many elderly people, especially those who have suffered with diabetes for a prolonged period, will have comorbidities that impact on the safety of fasting and present additional challenges to the HCPs managing them. Assessments of functional capacity and cognition need to be performed and the care provided should be adapted accordingly [19]. The current risk categorisation

considers those with old age combined with ill health as very high risk, however, old age on its own is not considered as an additional risk factor for fasting. The choice of anti-diabetic agents, which carry varying risks for hypoglycaemia, should also be considered.



Many older people have enjoyed fasting during Ramadan for many years and they should not be categorised as high risk based on a specific age but rather on health status and social circumstances

4.4.3 Pregnant women

Three quarters of Muslim pregnancies overlap with Ramadan and the risk to both the mother and foetus mean that pregnant women are exempt from fasting. However, many of these women will choose to fast. The possible effects of fasting on mother and foetus have been summarised in the *South Asian consensus statement on women's health and Ramadan* [20]. The risk categories proposed by the IDF-DAR (***Table 1***) take into consideration the differences between pregnancy in pre-existing diabetes and gestational diabetes mellitus (GDM). Some important factors to consider include:

- Pregnancy in pre-existing diabetes affects the pregnant woman throughout the duration of pregnancy, compared to the relatively shorter duration of GDM which normally develops during the second or third trimester
- The type of diabetes medication the woman with diabetes uses pre-pregnancy: incretins or thiazolidinediones are considered relatively low risk with regards to safety for fasting. However, during pregnancy, the vast majority of women with T2DM would be treated with insulin, metformin or glibenclamide. Insulin and glibenclamide carry a higher risk of hypoglycaemia if fasting [21, 22]
- Many are concerned about hypoglycaemia in Ramadan, however, for pregnant women hyperglycaemia is associated with increased risk for both mother and baby [10]. For this reason pregnant women with pre-existing diabetes or GDM are advised not to fast until further research data are available to support any change in risk category.

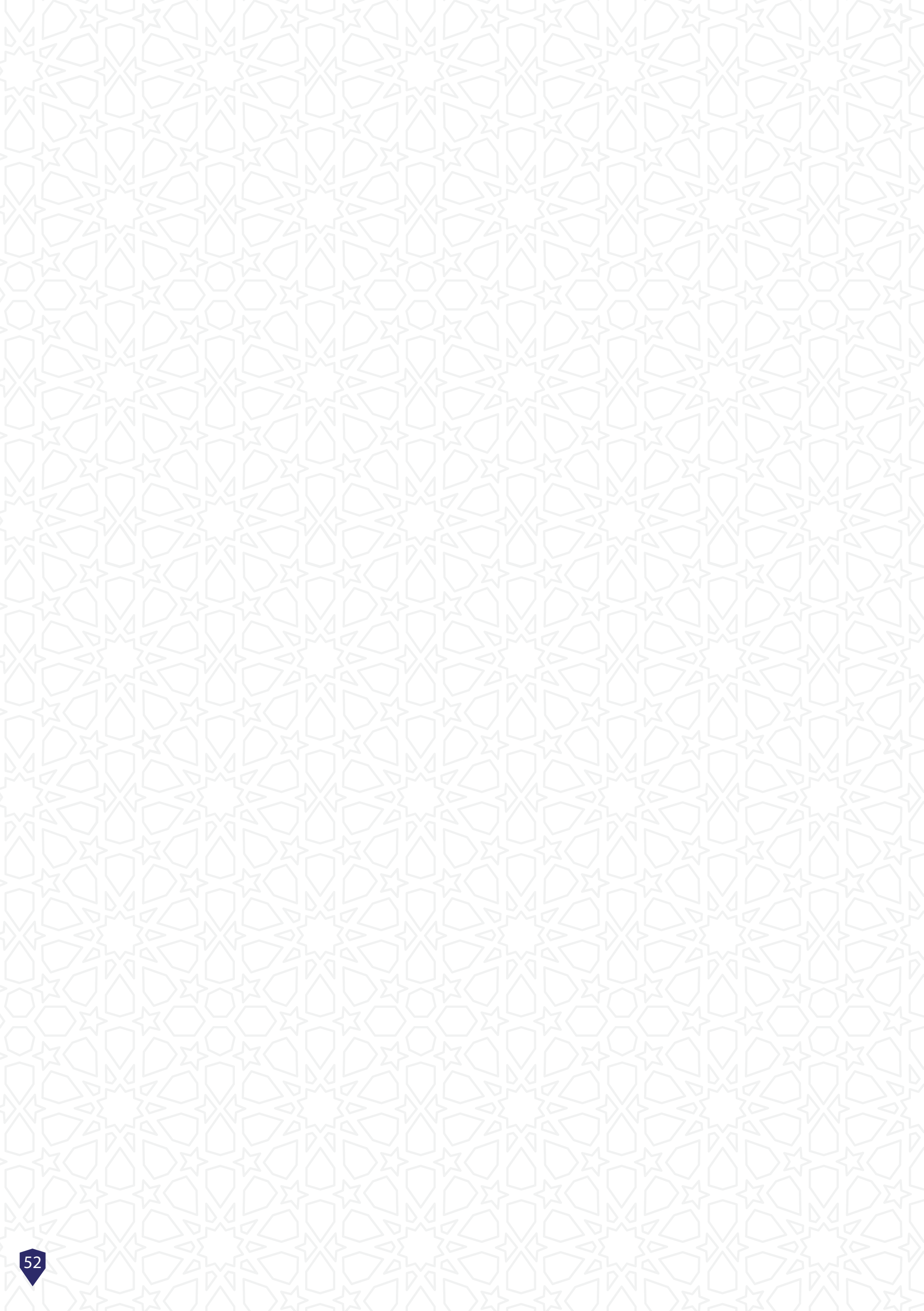
Summary

- With the correct guidance, many people with diabetes can fast safely during Ramadan but they must be under close supervision and be made aware of the risks.
- The risks associated with fasting include hypoglycaemia, hyperglycaemia, DKA, dehydration and thrombosis; physicians must quantify the risks and stratify each individual patient accordingly.
- The new IDF-DAR risk stratification approach defines three risk categories: very high, high and moderate/low.
- Patients who fast against the advice provided by their HCPs should follow experts' detailed guidance to avoid the development of serious complications.

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Chapter 5.
Diabetes and Ramadan: A Medico-religious Perspective

Mohamed Hassanein, Adel A El-Sayed, Khaled Tayeb, MAK Omar & Abdul Basit

5.1 Introduction

Ramadan fasting is one of the five pillars of Islam. It is incumbent upon every Muslim once puberty is attained, and thereafter, to keep fast during this month. The Holy Quran says: "O you who believe! Fasting is prescribed to you as it was prescribed to those before you so that you may attain self-restraint" [1] and "Whoever witnesses the month (of Ramadan) then he/she should fast. But, if any of you is ill or travelling – then he or she is exempted from fasting" [1].

As stated, certain categories of individuals – including children, the sick, travellers, women during menses, pregnancy or breastfeeding, and anyone with reduced mental capacity – are exempt from fasting [1]. The missed days of fast should be made up later when the individual is in sound health if the cause of not fasting was a temporary one.

5.2 Significance of Ramadan

Muslims believe that Ramadan is a blessed month as it honours the time when the Quran was revealed to the Prophet Muhammad and is the month of fasting when Allah's rewards for any good deeds are much higher than in any other time. This generally creates an intense and passionate desire to do one's utmost in order to seek the nearness and pleasure of God. In addition to fasting, Muslims engage in various other forms of devotion to a far greater degree in the month of Ramadan.

It is therefore not surprising that many Muslims who fall in the exempt categories, which would include those with acute or chronic diseases, are loath to take advantage of this concession. The reasons for such determination to keep the fast are not difficult to gauge. Perhaps a major factor is that the ill person feels that he or she would not be discharging his/her duty as a Muslim, notwithstanding the fact that he/she is aware of the exemption granted in the event of such a disease. On the other hand, many scholars, in awareness of the possible serious health risk for some people with medical conditions, feel that those who insist on fasting against medical advice are performing a seriously wrong action from a religious point of view as they could be jeopardising their health. Indeed, collaborative work between medical and religious experts is essential to ensure that those who do not fast due to their medical condition understand that they are indeed rewarded like those who fast and that they should not feel guilty.



It is essential to ensure that those who do not fast due to their medical condition understand that they are indeed rewarded like those who fast and should not feel guilty

5.3 Fasting and illness

The Quran clearly states that if one is ill, "the missed fast should be completed at another time", because "Allah intends ease for you and does not intend to put you in difficulty" [1]. But what constitutes an illness justifying such an exemption? Religious scholars have depended on the specific personal advice of an "expert Muslim physician to decide illnesses in which fasting may make conditions worse or delay healing" [2]. In contrast, doctors have often used medical jargon such as 'indications' and 'contraindications' and have offered varying opinions. This disparity is not helpful to either the patient or the healthcare professional (HCP) responsible for their care. Patients with diabetes can present with a range of complications and comorbidities all of which have an impact on the risk that fasting may impose on the individual. It should be acknowledged that not all patients will seek advice from an HCP prior to Ramadan. In fact, there is evidence to suggest that some patients prefer to discuss fasting with their local imam rather than their physician [3, 4]. A study has shown that imams are willing to include diabetes education within their teachings [5] and it is, therefore, important to have unification between HCPs and religious leaders on who should fast and who should seek exemption.



It is important to have unification between HCPs and religious leaders on which patients with diabetes should fast and who should seek exemption

5.4 Practical guidelines for the management of diabetes during Ramadan

Guidelines for the management of diabetes during Ramadan were first published by the American Diabetes Association (ADA) in 2005 [6]. Within these guidelines were recommendations for the classification of patients with diabetes into one of four risk categories: very high, high, moderate and low depending on the type of diabetes, medical history, glycaemic control, type of medication, presence of comorbidities and the individual's personal circumstances [6]. In 2009, at The Council of International Fiqh (the study of Islamic regulations) Academy of The Organisation of Islamic Conference (19th session), and as a result of deliberations by Islamic scholars and medical experts, the Fiqh Academy accepted the expert opinion expressed in the ADA Ramadan recommendations [2]. It was decided that those patients considered as very high and high risk should not fast while those in the remaining two categories could fast. With such recommendations in place, it is perhaps surprising that they are not always consulted. Analysis of patients with type 2 diabetes (T2DM) enrolled on the CREED study found that around one third of the physicians involved in their care did not consult guidelines for the management of diabetes during Ramadan [7].

When looking at the whole study population, including patients with type 1 diabetes (T1DM), the average number of days fasted by the highest and lowest risk groups only differed by three days [7]. This could suggest that either HCPs are not stratifying the patients correctly or that patients are ignoring the advice given to them by their physician and fasting even when told not to. A recent study involving nearly 200 physicians, mainly from the Middle East and North Africa, revealed that a majority stratified patients with diabetes in accordance with the categories defined in the ADA recommendations but not all the risks of fasting were identified by those providing care during Ramadan [8]. Hence, there is a clear need to reconsider the various risk categories and to provide a level of flexibility that would help the individual with diabetes and HCPs to make better decisions regarding fasting during Ramadan.

As part of these *IDF-DAR Practical Guidelines*, experts from the International Diabetes Federation (IDF) and the Diabetes and Ramadan (DAR) International Alliance have updated the risk classifications for fasting. As described in detail in Chapter 4, three categories are proposed, based on the most recent available information from science and practice during Ramadan fasting. These risk categories take into account a more practical approach while recognising the need to consider the everyday practice of many people with diabetes. Importantly, these recommendations are approved by the Mofty of Egypt, the highest religious regulatory authority in Egypt as well as being a scholar of Al-Azhar, one of the globally renowned Islamic academic organisations. The religious opinion on fasting for the three categories is outlined in ***Table 1***. All patients are instructed to follow medical advice and should not fast if the probability of harm is high. A summary of the approval by the Mofty of Egypt is available as an appendix to this document. It should be noted that this opinion may not reflect the religious rulings in all countries so further regional discussions are needed.



The new diabetes and Ramadan fasting risk categorisations described in these *IDF-DAR Practical Guidelines* have been approved by the Mofty of Egypt

Table 1. IDF-DAR risk categories and recommendations for patients with diabetes who fast during Ramadan

Risk category and religious opinion on fasting*	Patient characteristics	Comments
Category 1: **very high risk** **Listen to medical advice** **MUST NOT fast**	One or more of the following: • Severe hypoglycaemia within the 3 months prior to Ramadan • DKA within the 3 months prior to Ramadan • Hyperosmolar hyperglycaemic coma within the 3 months prior to Ramadan • History of recurrent hypoglycaemia • History of hypoglycaemia unawareness • Poorly controlled T1DM • Acute illness • Pregnancy in pre-existing diabetes, or GDM treated with insulin or SUs • Chronic dialysis or CKD stage 4 & 5 • Advanced macrovascular complications • Old age with ill health	If patients insist on fasting then they should: • Receive structured education • Be followed by a qualified diabetes team • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations • Be prepared to break the fast in case of hypo- or hyperglycaemia • Be prepared to stop the fast in case of frequent hypo- or hyperglycaemia or worsening of other related medical conditions
Category 2: **high risk** **Listen to medical advice** **Should NOT fast**	One or more of the following: • T2DM with sustained poor glycaemic control** • Well-controlled T1DM • Well-controlled T2DM on MDI or mixed insulin • Pregnant T2DM or GDM controlled by diet only or metformin • CKD stage 3 • Stable macrovascular complications • Patients with comorbid conditions that present additional risk factors • People with diabetes performing intense physical labour • Treatment with drugs that may affect cognitive function	
Category 3: **moderate/low risk** **Listen to medical advice** **Decision to use licence not to fast based on discretion of medical opinion and ability of the individual to tolerate fast**	• Well-controlled T2DM treated with one or more of the following: – Lifestyle therapy – Metformin – Acarbose – Thiazolidinediones – Second-generation SUs – Incretin-based therapy – SGLT2 inhibitors – Basal insulin	Patients who fast should: • Receive structured education • Check their blood glucose regularly (SMBG) • Adjust medication dose as per recommendations

*In all categories people with diabetes should follow medical opinion if the advice is not to fast due to high probability of harm

**The level of glycaemic control is to be agreed upon between doctor and patient according to a multitude of factors

CKD, chronic kidney disease; DAR, Diabetes and Ramadan International Alliance; DKA, diabetic ketoacidosis; GDM, gestational diabetes mellitus; IDF, International Diabetes Federation; MDI, multiple dose insulin; SGLT2, sodium-glucose co-transporter-2; SMBG, self-monitoring of blood glucose; SU; sulphonylurea; T1DM, type 1 diabetes mellitus; T2DM, type 2 diabetes mellitus

The recent religious opinion of the Mofty of Egypt emphasises the importance of the discussion between physician and patient when considering fasting or not and takes into consideration the ability of the person with diabetes to tolerate the fast. Furthermore, the religious advice of the Mofty of Egypt stresses that where obvious contraindications are present, it behoves the doctor to give categorical advice against fasting and highlights the importance of accepting this advice by the person with diabetes. Indeed, such patients should be reminded of the Quranic injunction: "Let not your own hands throw you into destruction" [9]. Moreover, there is a Hadith (Prophetic teaching) wherein he stated: "God has a right over you. Your body has a right over you …".

With medical and religious experts in agreement it is important that these recommendations are disseminated and implemented. For this to happen the following ideals should be realised:

- Doctors should be briefed with an acceptable knowledge of Fiqh provisions on this subject
- Religious scholars should instruct patients to consult those doctors who understand the medical and religious aspects of fasting and are God fearing
- Imams need to acquaint themselves with these regulations and with the risks of diabetes when they are advising any Muslim person with diabetes with regards to fasting regulations
- All efforts need to be made using media and other communication avenues to ensure that people with diabetes are aware of these regulations; this should help to increase the level of acceptance of the medico-religious decision in the event that it is to refrain from fasting.

In recognition of the sincere efforts made in this regard by experts in their specialty, all doctors and patients should comply with the joint medical and religious recommendations. There is also a need for continued scientific research in this area to build up practical experiences that will in turn lead to more accurate decisions. However, it is important to clarify some points that are of concern for people with diabetes who intend to fast during Ramadan:

- The religious feelings and psychological state of people with diabetes must not be overlooked, as most of them find psychological and physical comfort in fasting and will insist on the performance of this duty despite medical advice not to fast. Many will have observed fasting before with no apparent harm to their health. As psychological satisfaction is important, it is the duty of their specialist doctor to make every effort to help people with diabetes fast unless they find a real medical risk. It is also essential to educate such patients to help them avoid dramatic changes in their blood glucose while fasting and to give them strict instructions to break their fast if they need to

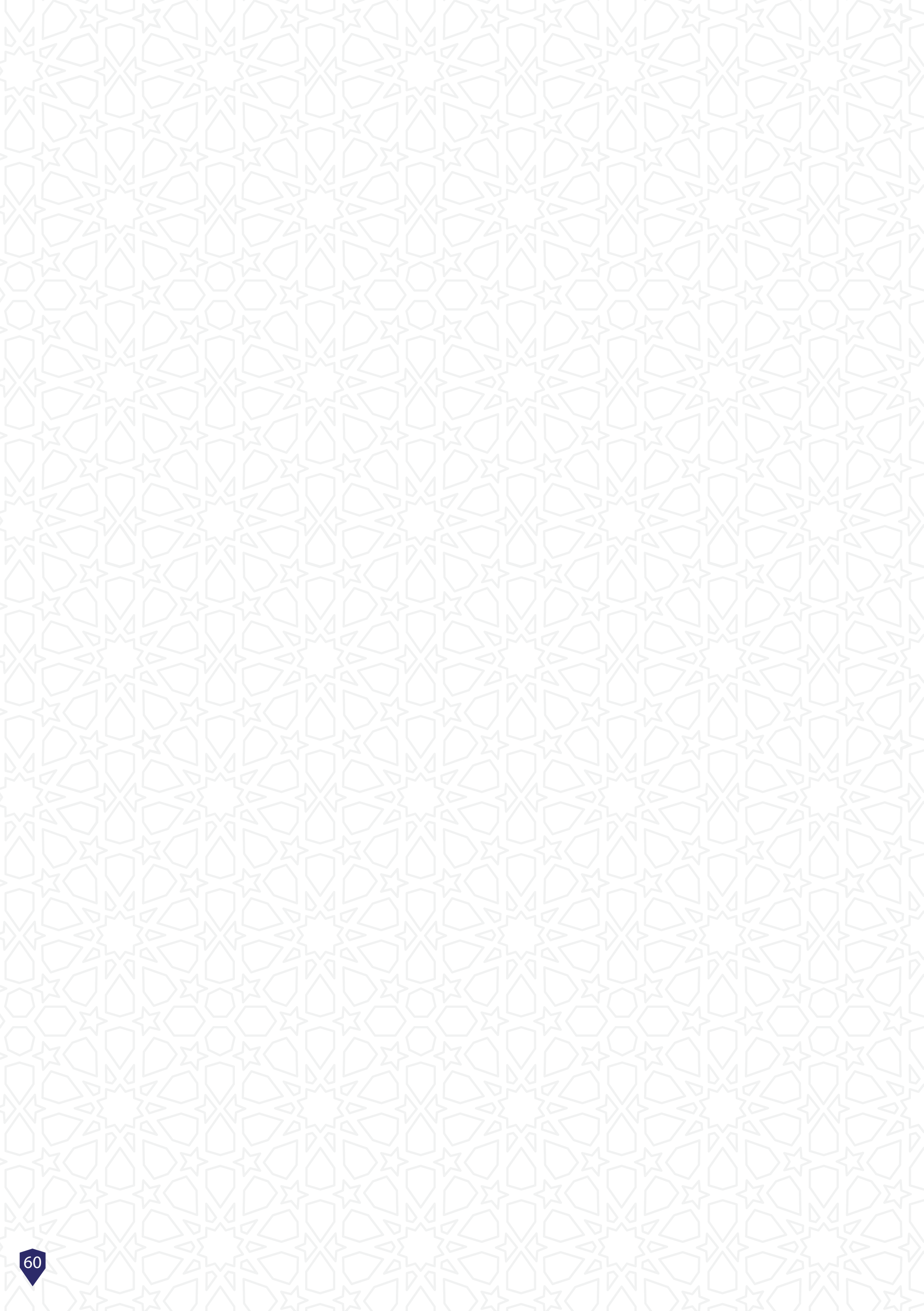
- Consideration should be made for the duration of the fasting hours, which may be 18 hours or more in some regions, such as Northern Europe. This undoubtedly increases the difficulty of fasting for people with diabetes
- It should be emphasised that people who have had diabetes for many years are more prone to the chronic complications of this disease and even if they were classified as low risk one year they should not assume they are still low risk the following year
- Other factors that may determine the ability of a patient with diabetes to fast should be addressed including general health, lifestyle, type and hours of work, ambient temperature and availability of medical support.

Summary

- Fasting during the month of Ramadan is a religious obligation for all healthy adults. However, Islamic regulations have exempted those afflicted with illness from this obligation.
- Harmony between medical and religious advice is essential to ensure safe fasting for people with diabetes. Indeed, the risk stratification groups defined in these *IDF-DAR Practical Guidelines* have been endorsed by the highest religious regulatory authority of Egypt.
- HCPs, religious authorities, as well as people with diabetes, need to be made aware of these regulations through all possible avenues.

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Chapter 6.
Pre-Ramadan education

Mohamed Hassanein & Muhammad Yakoob Ahmedani

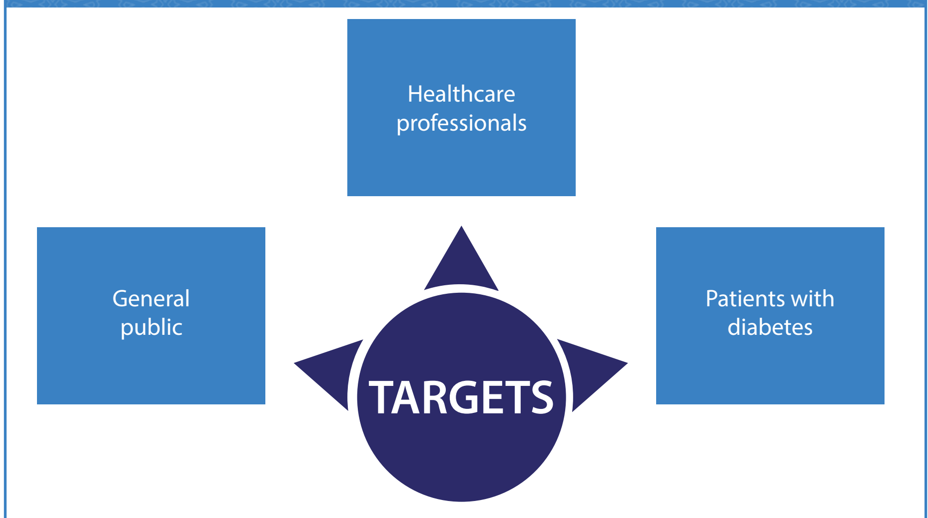
6.1 Education as a cornerstone for Ramadan diabetes management

Structured diabetes education is about giving patients the knowledge to make informed decisions regarding their behaviour and enabling them to effectively selfmanage their condition [1]. Ramadan-focused diabetes education is an extension of this process. The pivotal Epidemiology of Diabetes and Ramadan (EPIDIAR) study demonstrated that only around two-thirds of patients with diabetes received recommendations from their healthcare professionals (HCPs) regarding management of their condition during Ramadan, and highlighted a need for more intensive education prior to fasting [2]. In the more recent CREED study, 96% of physicians provided advice to fasting patients, although only 63% used guidelines or recommendations to do so [3]. In addition, only 67% of physicians used a Ramadan-focused educational programme [3]. The objective of Ramadan-focused education is to raise awareness of the risks associated with diabetes and fasting, and to provide strategies to minimise them. Education should be simple, engaging, and delivered with cultural sensitivity by well informed individuals. In studies, Ramadan-focused educational programmes have been successful in enabling patients with diabetes to maintain and improve glycaemic control during and after fasting [4, 5].

6.2 Targets of Ramadan-focused diabetes education

Ramadan-focused diabetes education should primarily be targeted to patients with diabetes, but also directed to the HCPs who manage these patients, and more widely to the general public who may support them (***Figure 1***).

Figure 1. Targets of Ramadan-focused diabetes education



6.2.1 The general public

Educational campaigns that target the general public should aim to raise awareness of the issues and misconceptions that surround diabetes and Ramadan fasting, and emphasise the importance of maintaining good diabetes management during fasting. In addition to medical advice, religious regulations should be included. For example, it should be made clear that individuals may be exempt from fasting during Ramadan if they are ill, and they can either make up for missed fasting days when they are better or donate food or money to the poor as an alternative (fidya). In particular, campaigns should be aimed at religious and community leaders as they are valued and trusted members within the target community and may be turned to for advice in place of or in addition to HCPs [6, 7]. It is important, therefore, that these individuals are themselves well-informed. Providing clear advice that aligns with both medical and religious perspectives can improve and encourage communication between healthcare services and the Muslim community.

6.2.2 Healthcare professionals

A lack of knowledge and awareness about fasting and diabetes means advice and guidance provided by HCPs may be inappropriate or lacking, especially in Muslim-minority countries. For example, in a survey of HCPs in the US, only one-third of physicians actively enquired whether their Muslim patients intended to fast during Ramadan, and many did not feel comfortable managing these patients [8]. Similarly, in France, a lack of medical knowledge surrounding Ramadan fasting and diabetes led to inappropriate advice being given to patients, together with inadequate patient education [9]. Ensuring HCPs are knowledgeable and adequately trained is therefore vital for the provision of appropriate advice and optimal diabetes care. Cultural competency is essential for effective education and patient care, impacting how both are given and received [10].



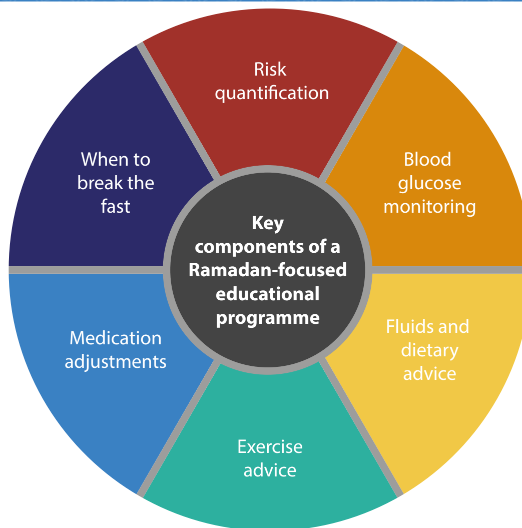
HCPs should be trained to deliver Ramadan-focused diabetes education in a culturally sensitive manner

HCPs should be trained to recognise and understand the different cultural and religious aspects of fasting and how these may impact on the management of diabetes [11]. For example, they should understand the religious feelings of patients who insist on fasting despite having an illness that could potentially exempt them. Among patients with type 2 diabetes (T2DM), culturally appropriate health education has proven more effective than 'usual' health education in improving glycaemic control and knowledge about diabetes and its management in the short-to-medium term [12]. HCPs should have the skills and confidence to deliver advice in a culturally sensitive manner in order to encourage communication, improve the patient-doctor relationship, and provide better overall care [13, 14].

6.2.3 Patients with diabetes

Pre-Ramadan education can greatly benefit patients with diabetes in terms of maintaining glycaemic control and preventing weight gain [4, 5]. Education programmes can provide the knowledge and tools for individuals to effectively manage their condition during Ramadan by making key changes to their behaviour and lifestyle in order to minimise the risks [4, 5]. Educational programmes may be provided as group sessions or one-to-one consultations, given in a medical or community setting by physicians, dieticians and/or community link workers. The main areas of diabetes education that should be provided prior to Ramadan are discussed below (***Figure 2***).

Figure 2. Key components of a Ramadan-focused educational programme



6.3 Key areas of pre-Ramadan diabetes education

Although multiple approaches may be taken to increase awareness of the issues of diabetes management during Ramadan, education is fundamental for the provision of optimal care when fasting. Patients should have a clear understanding of how, by changing their behaviours, they can minimise potential risks.

6.3.1 Risk quantification

All patients with diabetes should attend a pre-Ramadan assessment with their HCP 6–8 weeks before the start of Ramadan. In the assessment, the risks to patients who intend to fast should be quantified. Factors that contribute to the risk include

the type of diabetes, current diabetes medication, individual social and work circumstances, individual hypoglycaemic risk, self-management capabilities and the presence of any complications and/or comorbidities. Patients can then be stratified according to their potential risk and an individualised approach to disease management provided to ensure optimal care is delivered (see Chapter 4). Although existing recommendations advise that patients who fall in the 'very high' and 'high' risk categories do not fast, it should be acknowledged that many Muslims will still wish to do so and these patients should be provided with the appropriate knowledge and support to minimise the risks they face [15, 16].

6.3.2 Blood glucose monitoring

There is a misconception held by some Muslim communities that pricking the skin for blood glucose testing invalidates the Ramadan fast [17]. It should be strongly emphasised in educational programmes that this is not the case. Indeed, checking blood glucose levels is an essential component of diabetes care, and patients should be provided with the tools and knowledge to carry out self-monitoring of blood glucose (SMBG). Having these skills can empower patients to effectively self-manage their disease and better identify and prevent episodes of hypoglycaemia and hyperglycaemia. This is particularly important during Ramadan when changes in diet and lifestyle can increase the incidence of these events. Also, by regularly measuring blood glucose, patients may become more conscious of their eating habits and the impact on their blood glucose levels, potentially curbing damaging behaviours.



Having the skills to self-monitor blood glucose levels can empower patients with diabetes to effectively self-manage their disease

The frequency of SMBG depends on many factors including the type of diabetes and current medications but should be carried out regularly by all. For those at moderate or low risk, this may be once or twice a day. Those at high or very high risk should check their blood glucose levels several times a day (see Chapter 8). Similarly, patients on insulin and/or sulphonylureas may choose to monitor their blood glucose levels more frequently because of the increased risk of hypoglycaemia associated with these medications. The data generated are also useful for guiding dose titration (see Chapter 8) [18]. It is important for all patients with diabetes to measure blood glucose levels after iftar to detect postprandial hyperglycaemia. Also, patients should check blood glucose levels whenever they experience symptoms of hypoglycaemia, hyperglycaemia or feel unwell, and understand when they should immediately break the fast (see ***Figure 3***). Regular monitoring of blood glucose levels formed a vital component of the successful educational programmes implemented in the studies described in section 6.4 [4, 5].

6.3.3 Fluids and dietary advice

The fasting and feasting nature of Ramadan can encourage the consumption of large, carbohydrate-heavy meals, and sugary drinks and treats that can impact blood glucose levels potentially increasing the risk of complications in patients with diabetes [19]. Providing dietary advice and meal planning can help patients with diabetes to follow a healthy balanced diet during Ramadan, reducing the likelihood of these complications. It may also lead to lifestyle changes that favour weight loss that may continue once fasting has stopped. Key dietary advice that should be followed during Ramadan is shown in ***Table 1*** and discussed in detail in Chapter 7.

Table 1. Dietary advice for patients with diabetes during Ramadan
• Divide daily calories between suhoor and iftar, plus 1–2 snacks if necessary
• Ensure meals are well balanced   • 45–50% carbohydrate   • 20–30% protein   • <35% fat (preferably mono- and polyunsaturated)
• Include low glycaemic index, high fibre foods that release energy slowly before and after fasting   • E.g. granary bread, beans, rice
• Include plenty of fruit, vegetables and salads
• Minimise foods that are high in saturated fats   • E.g. ghee, samosas, pakoras
• Avoid sugary desserts
• Use small amounts of oil when cooking   • E.g. olive, rapeseed
• Keep hydrated between sunset and sunrise by drinking water or other non-sweetened beverages
• Avoid caffeinated and sweetened drinks

6.3.4 Exercise

Although rigorous exercise is not recommended during fasting because of the increased risk of hypoglycaemia and/or dehydration, patients with diabetes should be encouraged to take regular light-to-moderate exercise during Ramadan. Patients should be reminded that the physical exertions involved in Tarawih prayers, such as bowing, kneeling and rising, should be considered part of their daily exercise activities.

6.3.5 Medication adjustments during fasting

The change in lifestyle and eating patterns during Ramadan places patients with diabetes at an increased risk of hypoglycaemia during the daytime and hyperglycaemia at night. The type of diabetes medication can also impact this risk. In the pre-Ramadan assessment, the HCP may adjust the dose, timing or the type of medication to minimise the risk to the patient. Recommendations on treatment modifications are discussed in detail in Chapter 8.



Adjustments to the dose and/or timing of some medications may be required during Ramadan to minimise the risk of hypoglycaemia in fasting patients

6.3.6 When to break the fast

Patients should be educated to recognise the symptoms of hypoglycaemia and hyperglycaemia [20], and be advised to test their blood sugar whenever any of these complications (or an acute illness) occur, and be prepared to break the fast if necessary (***Figure 3***). When breaking the fast because of hypoglycaemia, patients should consume a small amount of a fast-acting carbohydrate e.g. a small carton of juice, and retest their blood after 15–20 minutes [21].

Figure 3. When to break the fast

All patients should break their fast if:

- **Blood glucose <70 mg/dL (3.9 mmol/L)**
  - re-check within 1 h if blood glucose 70–90 mg/dL (3.9–5.0 mmol/L)
- **Blood glucose >300 mg/dL (16.6 mmol/L)***
- **Symptoms of hypoglycaemia, hyperglycaemia, dehydration or acute illness occur**

Hypoglycaemia	Hyperglycaemia
• Trembling • Sweating/chills • Palpitations • Hunger • Altered mental status • Confusion • Headache	• Extreme thirst • Hunger • Frequent urination • Fatigue • Confusion • Nausea/vomiting • Abdominal pain

*Consider individualisation of care.

6.4 Evidence of benefit of Ramadan-focused diabetes education

6.4.1 The Ramadan Education and Awareness in Diabetes (READ) study

In this study from the UK, general practitioners based in London attended an educational Ramadan and diabetes workshop to gain understanding of the issues surrounding diabetes and fasting [5]. Participants then provided a 2-hour pre-Ramadan educational programme to patients with T2DM (n=57). Patients attended group sessions (led by an ethnic specialist dietician and a diabetes specialist nurse practitioner) which included both general and Ramadan-specific diabetes information on dietary advice and meal planning, physical activity, blood glucose monitoring, recognising and managing complications, and dosing and timing of medications. Patient weight and the incidence of hypoglycaemic events before and after Ramadan were compared with that of a control group of 54 patients with T2DM who did not attend the educational programme. One month after Ramadan, those who attended the programme demonstrated a significant loss in weight compared with before Ramadan (mean -0.7 kg, $p<0.001$) whereas there was a significant weight gain in the control group (mean +0.6 kg, $p<0.001$). There was also a significant decrease in the number of hypoglycaemic events in the group that received diabetes education (from nine events pre-Ramadan to five during Ramadan), compared with an increase (from nine to 36 events) in the control group. The study also demonstrated sustained glycaemic control in patients one year after attending the programme which was not evident in the control group [5].



The READ programme was associated with weight loss and a significant reduction in hypoglycaemic events during Ramadan

The authors noted that the success of the programme was in part due to the proactive approach of community link workers who encouraged and motivated individuals within the community to attend the programme. In addition, the involvement of culturally diverse staff and delivery of the sessions in four different languages enhanced accessibility of the programme to attendees.

6.4.2 The Ramadan Diabetes Prospective Study

Patients with type 1 diabetes or T2DM (n=110) were recruited to attend two educational sessions held on a one-to-one basis at the outpatient department of the Baqai Institute of Diabetology and Endocrinology in Pakistan [4]. In one session, given by a doctor, the physical well-being and glycaemic control of the patient was evaluated and any necessary adjustments to drug dosing and timing were made. Patients were advised to record their blood glucose readings twice a day for

at least 15 days during Ramadan and were educated about the warning signs of complications. In the other session, the diet and lifestyle of the patient was assessed by a dietician and adjusted for optimal energy consumption during Ramadan. The impact of this programme on the occurrence of diabetes complications during Ramadan was assessed. The study demonstrated a downward trend in symptomatic hypoglycaemic episodes from week 1 to week 4 of Ramadan with only one patient experiencing a severe hypoglycaemic event. No patients developed diabetic ketoacidosis or hyperglycaemic hyperosmolar state. The authors concluded that altering drug dosage, dietary counselling and patient education, together with regular blood glucose monitoring enabled patients to fast without major complications [4].

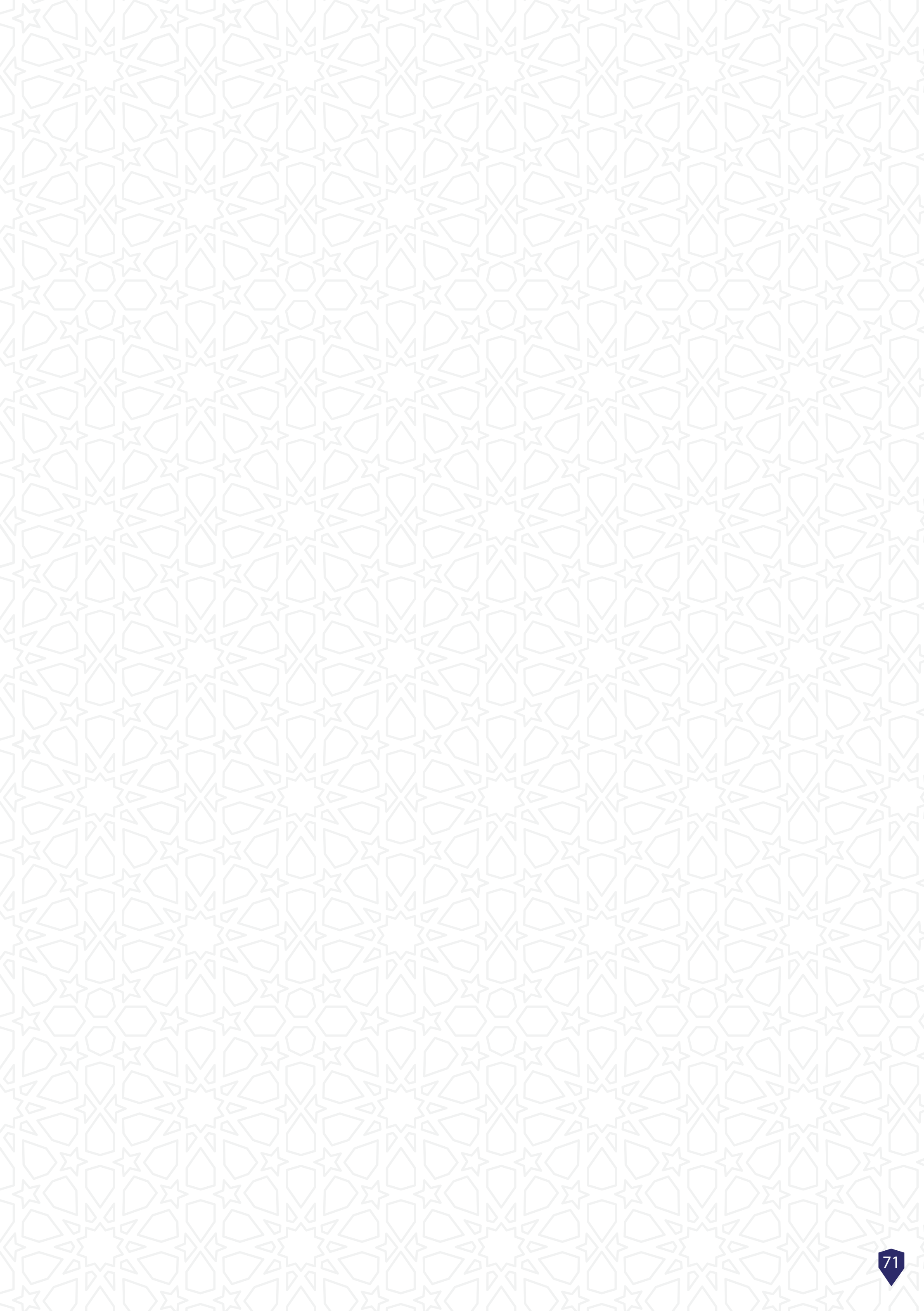
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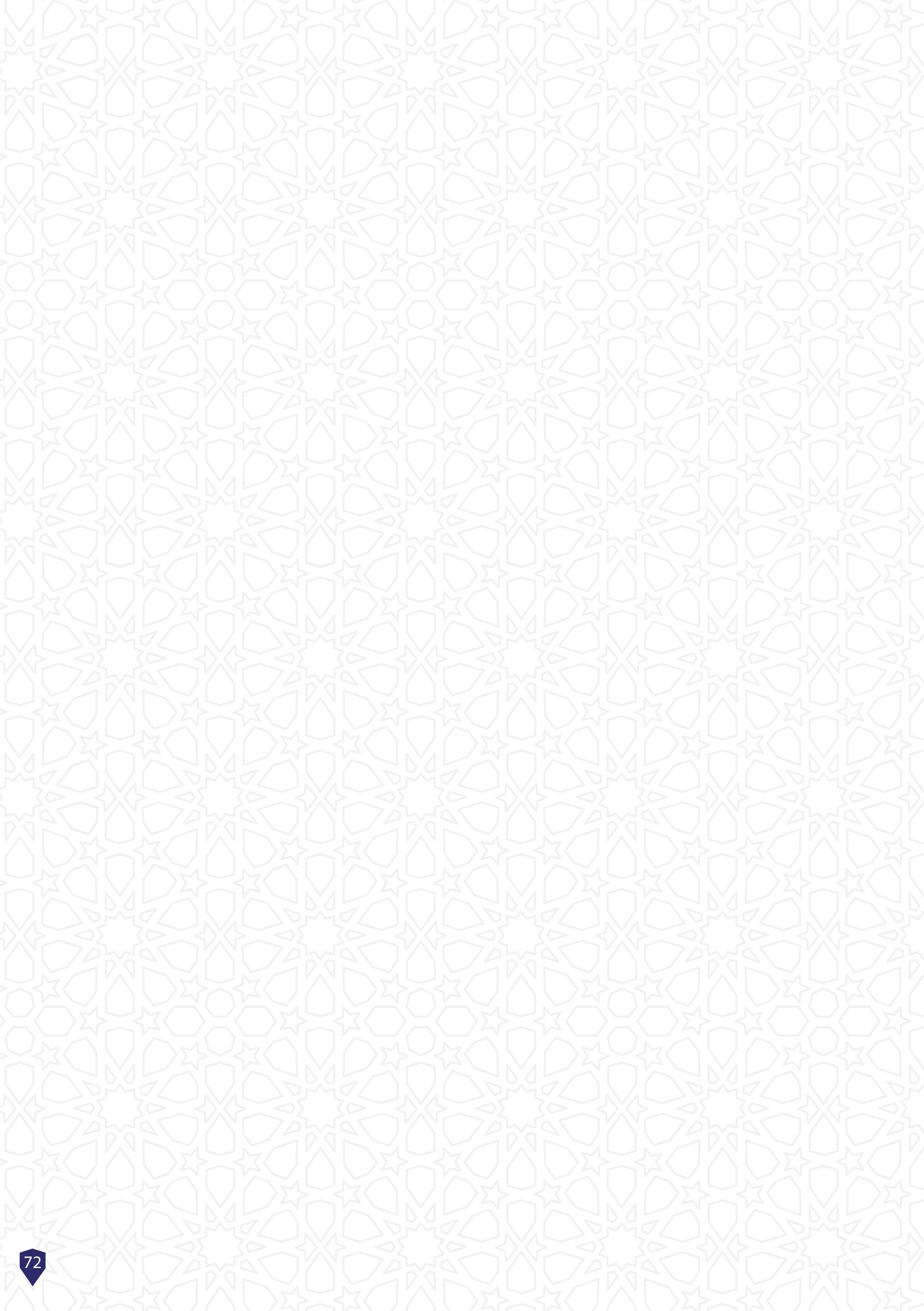
- Education is an essential component of diabetes management during Ramadan.
- Programmes should be aimed at patients with diabetes, the HCPs who manage them and the general public who support them.
- A structured educational programme should include information on risk quantification, blood glucose monitoring, diet, exercise, medication adjustments, recognition of the symptoms of complications and when to break the fast to prevent harm.
- Studies have demonstrated a clear benefit of Ramadan-focused education programmes in terms of glycaemic control, weight loss and a reduced risk of hypoglycaemic events.
- The positive outcomes of these programmes may also extend beyond the month of fasting.

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Chapter 7.
The Ramadan Nutrition Plan (RNP) for Patients with Diabetes

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Wafa H Reda, Ines Slim, Henda Jamoussi & MAK Omar

7.1 Introduction to the Ramadan Nutrition Plan

The Ramadan Nutrition Plan (RNP) is a mobile and web-based application designed to help healthcare professionals (HCPs) individualise medical nutrition therapy (MNT) for patients with diabetes during Ramadan fasting. The RNP also has a patient platform that provides education and nutrition plans for Ramadan, which may be particularly useful for people with diabetes who do not have access to HCPs. The role of MNT is vital during this period of fasting, not only in achieving optimal diabetes control but also in helping overweight and obese patients with type 2 diabetes (T2DM) improve their lifestyle and lose weight [1, 2]. In fact, Ramadan provides an ideal opportunity for patients to channel the strength and discipline required to comply with MNT; this in turn helps them to maintain optimal glycaemic control beyond the month of Ramadan.

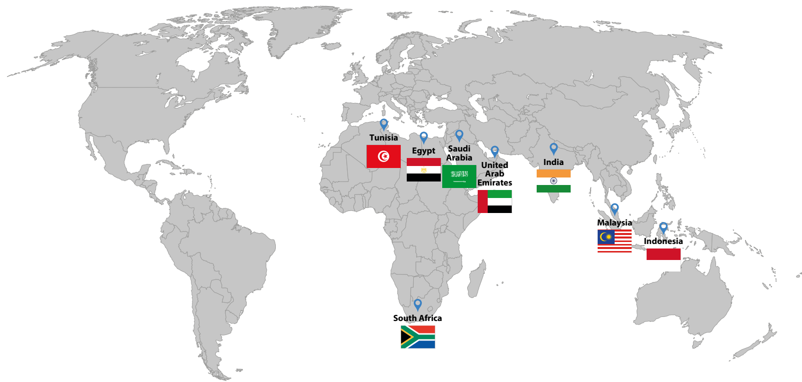
The RNP is based on the principles of optimal MNT and provides examples of meal plans for different countries and regions across the globe. However, dietary recommendations should be individualised and tailored to patients' lifestyle requirements, age, comorbidities and other medical needs [3, 4]. The RNP is a work in progress and will benefit from further contributions by HCPs of different nationalities, based on the structure provided in this chapter. This will result in the production of a comprehensive global menu resource.

The main aims of MNT during Ramadan fasting are to ensure that:

1. Patients consume an adequate amount of calories, with balanced proportions of macronutrients, during the non-fasting period (i.e. sunset to dawn) to prevent hypoglycaemia during the fasting period
2. Patients distribute their carbohydrate intake equally among meals to minimise postprandial hyperglycaemia
3. Patients and HCPs consider comorbidities such as hypertension and dyslipidaemia.

The RNP has been adopted for use in many countries (***Figure 1***). When accessing the RNP, the HCP can select their country of practice from the "Ramadan map" to gain country-specific best-practice MNT recommendations (***Figure 1***).

Figure 1. The RNP Ramadan map



Access the online version at www.daralliance.org or www.idf.org and click on your country to view a full nutrition plan. Print the plan and hand it to your patients

7.2 The pre-Ramadan patient visit

An assessment of patient nutrition, as part of a pre-Ramadan patient visit 6–8 weeks before Ramadan, provides an opportunity for HCPs to advise patients with diabetes about the necessary dietary modifications that should be adopted during Ramadan. It may also help those patients who choose to fast for a few days during the 2 months preceding Ramadan.

The main aims of a pre-Ramadan patient visit are to [5]:

1. Provide patients with a modified nutrition plan that will improve glycaemic control during Ramadan fasting
2. Provide patients with MNT that may help overweight and obese patients to successfully and safely lose weight during Ramadan
3. Adjust anti-diabetic medications in line with patients' changes in nutrition during fasting
4. Encourage proper exercise and physical activity during Ramadan
5. Provide education to help patients recognise the warning symptoms of dehydration, hypoglycaemia and other possible acute complications
6. Enforce the importance of blood glucose and body weight monitoring during Ramadan.

7.3 Risk avoidance during Ramadan

For patients with diabetes, there are several potential risks associated with prolonged fasting. It is therefore important to increase patient awareness of these and to reduce risks while, if possible, enabling patients to participate in their spiritual experience of fasting during Ramadan. Many diabetes-related risks can be minimised through proper nutrition, including [2, 6]:

1. Hypoglycaemia, especially during the late period of fasting before iftar
2. Severe hyperglycaemia after each of the main meals
3. Dehydration, especially in countries with prolonged fasting hours and hot climates
4. Significant weight gain due to increased caloric intake and reduced physical activity
5. Electrolyte imbalance
6. Acute renal failure in patients prone to severe dehydration, particularly elderly patients and those with impaired kidney function.

7.4 Health issues during Ramadan

During Ramadan, there is a dramatic change in dietary patterns for fasting Muslims compared with other months of the year. Health issues may arise due to improper eating habits and reduced physical activity [7].

Unhealthy nutrition habits that commonly develop during Ramadan include:

1. Eating particularly large meals at iftar (frequently containing more than 1500 calories), which may result in severe postprandial hyperglycaemia and weight gain
2. Eating significant amounts of highly processed carbohydrates and sugar at iftar, or between iftar and suhoor, which may also cause severe hyperglycaemia
3. Eating desserts loaded with sugar after iftar, which can lead to a prolonged period of postprandial hyperglycaemia
4. Having large and frequent snacks between the two main meals, which can contribute to longer periods of hyperglycaemia
5. Eating at a fast speed, which frequently leads to over-eating (satiety signals usually take around 30 minutes to reach the brain from the start of eating)
6. Eating suhoor early, which may result in hypoglycaemia before iftar, especially when fasting hours are longer than usual
7. Consumption of large portions of high glycaemic index (GI) carbohydrates at suhoor, which can lead to postprandial hyperglycaemia [8, 9]

8. Frying food, which is particularly unhealthy, especially when using trans-fat margarine or oils rich in saturated fat (e.g. palm oil and coconut oil)
9. Changes in physical activity and sleeping patterns can affect metabolism and may contribute to weight gain [10].

7.5 Weight maintenance and weight reduction during Ramadan

Weight gain during Ramadan should be avoided. Patients with T2DM who are overweight or obese may find that Ramadan provides a good opportunity to lose weight. Weight loss may result in a significant improvement in glycaemic control and may reduce cardiovascular risk [11, 12]. An optimal target is a modest and gradual weight reduction of 0.5–1 kg per week. In order to achieve weight loss or avoid weight gain, caloric intake should be controlled and kept within specified targets based on height and gender (***Table 1***). It is also recommended to proportionally distribute caloric intake between suhoor and iftar (***Table 2***). In the RNP app, an algorithm provides guidance for selecting appropriate caloric targets for individual patients (***Figure 2***).

Table 1. Caloric targets for men and women during Ramadan

	Weight maintenance	Weight reduction
Men	1800–2200 kcal/day	1800 kcal/day
Women >150 cm tall	1500–2000 kcal/day	1500 kcal/day
Women <150 cm tall	1500 kcal/day	1200 kcal/day

Table 2. Daily caloric intake distribution during Ramadan

	Percentage of total calories/day
Suhoor	30–40%
Iftar	40–50%
Snack between meals (one or two, if necessary)	10–20%

Figure 2. RNP caloric guide for weight reduction and weight maintenance (RNP algorithm 1)

Daily caloric intake	1200 kcal	1500 kcal	1800 kcal	2000 kcal
Effect	Weight reduction for women <150 cm tall	Weight maintenance for women <150 cm tall & weight reduction for women >150 cm tall	Weight maintenance for women >150 cm tall & weight reduction for men	Weight maintenance for women >150 cm tall & for men

7.6 The 10 principles of the RNP

Based on the goal of achieving optimal MNT during Ramadan, the principles of the RNP are defined as:

1. Consume an adequate amount of total daily calories and divide them between suhoor, iftar and if necessary, 1–2 snacks (***Tables 1 and 2***)
2. Meals should be balanced, with carbohydrates (low GI preferred) comprising around 45–50%; protein (legumes, fish, poultry or lean meat) comprising 20–30%; and fat (mono and polyunsaturated fat preferred) comprising <35% of the meal (***Table 3***). Saturated fat should be limited to <10% of the total daily caloric intake
3. Use the "Ramadan plate" method for designing meals (***Figure 3***)
4. Sugar-heavy desserts should be avoided after iftar and between meals. A moderate amount of healthy dessert is permitted, for example a piece of fruit
5. Select carbohydrates with low GI, particularly those high in fibre (preferably whole grains). Consumption of carbohydrates from vegetables (cooked and raw), whole fruits, yoghurt and dairy products is encouraged. Consumption of carbohydrates from sugar and highly processed grains (wheat flour and starches like corn, white rice and potato) should be avoided or significantly minimised
6. Maintaining adequate hydration by drinking enough water and non-sweetened beverages at or between the two main meals is important and should be encouraged (diet beverages may be consumed). Sugary drinks, canned juices or fresh juices with added sugar should be avoided. Consumption of caffeinated drinks (coffee, tea as well as cola drinks) should be minimised as they are diuretics
7. Take suhoor as late as possible, especially when fasting for >10 hours
8. Consume an adequate amount of protein and fat at suhoor as foods with higher levels of these macronutrients and lower levels of carbohydrate have a lower GI than carbohydrate-rich foods, and do not have an immediate effect on postprandial blood glucose. Protein and fat also induce satiety better than carbohydrates
9. Iftar should begin with plenty of water to overcome dehydration from fasting, and 1–2 dried or fresh dates to raise blood glucose levels

10. If needed, a snack of one piece of fruit, a handful of nuts, or vegetables may be consumed between meals. Generally, each snack should be 100–200 calories, but this may be higher depending on the individual's caloric requirement. Some individuals may use a snack to break fasting and then eat iftar later in the evening.

Table 3. Macronutrient meal composition

Meals should be balanced. The "Ramadan plate" method is advised as a guide to designing meals *(Figure 3)*

Macronutrient	Category	Guidance
Carbohydrate	*Percentage*	• The total daily intake of carbohydrate should be at least 130 g/day and ideally 45–50% of the total caloric intake • Intake should be adjusted to meet the cultural setting and food preference of each individual
	Recommended	• Carbohydrate foods with low glycaemic index and load should be selected (e.g. whole grain, legumes, temperate fruits, green salad and most vegetables) • Fibre intake should be approximately 20–35 g/day (14 g/1000 kcal). This helps to provide satiety while fasting • Fibre from unprocessed food, such as vegetables, fruits, seeds, nuts and legumes is preferable
	Not recommended	• Sugar, refined carbohydrates, processed grains and starchy foods should only be consumed in limited quantities, especially sugary beverages, traditional sugar-heavy desserts, white rice, white bread, low fibre cereals and white potatoes
Protein[†]	*Percentage*	• Protein intake should not be less than 1.2 g/kg of adjusted body weight* and usually accounts for 20–30% of total caloric intake. Protein is important as it enhances satiety. Protein also helps to maintain lean body mass [13]
	Recommended	• Fish, skinless poultry, dairy, nuts, seeds and legumes are recommended
	Not recommended	• Protein sources that are high in saturated fats (e.g. beef, lamb) should not be consumed in excess, as this increases the risk of cardiovascular disease
Fat	*Percentage*	• Fat should comprise less than 35% of the total daily caloric intake. There is general agreement that the type of fat consumed influences cardiovascular disease risk • SFA should be limited to <10% of total daily caloric intake. PUFA and MUFA should comprise the rest of the daily fat caloric allowance
	Recommended	• PUFA and MUFA (e.g. olive oil, vegetable oil or blended oil [PUFA and palm oil]) are recommended. Oily fish (e.g. tuna, sardines, salmon) are recommended as a source of omega-3 fatty acids
	Not recommended	• Foods high in saturated fat, including red and processed meats (beef, lamb, hot dog, salami, luncheon meat), and ghee, and foods high in trans-fats (fast food, cookies, margarines and butter made of partially-hydrogenated oil) are not recommended

MUFA, monounsaturated fatty acids; PUFA, polyunsaturated fatty acids; SFA, saturated fatty acids
*Adjusted body weight = Ideal body weight (IBW) + (0.25 x [Current weight – IBW])
[†]Patients with renal issues may have different protein requirements and should receive individualised advice

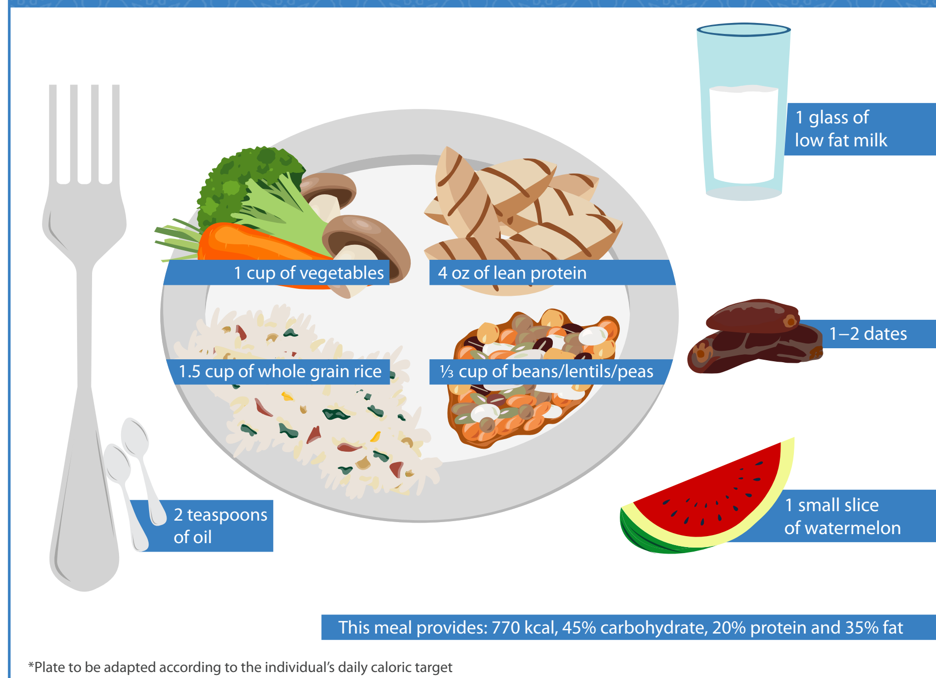


Figure 3. Example of a Ramadan plate*

*Plate to be adapted according to the individual's daily caloric target

7.7 The RNP: a transcultural application

In the RNP, a second algorithm and a toolkit provide meal plans for the four caloric targets (1200, 1500, 1800 and 2000 kcal/day). These are available online within the RNP app in order to support the nutrition needs of patients with diabetes during Ramadan. Meal plans have been tailored for different countries, providing a transcultural user experience. Examples for Egypt, Malaysia and South Africa are shown at the end of this chapter. The RNP is a work in progress and HCPs of different nationalities are encouraged to contribute menus to the RNP at www.daralliance.org. Healthy menus, based on the structure provided in this chapter, can be submitted online for review and, if accepted, will subsequently be posted on the RNP platform.

Summary

- The RNP is a mobile and web-based application designed to help HCPs individualise and implement MNT for patients with diabetes during Ramadan. It also helps patients without access to HCPs to construct a healthy eating plan for Ramadan.
- The RNP helps patients with diabetes to plan a daily caloric target that may help them to maintain body weight if they are lean, or to lose weight if they are overweight or obese.
- Use of the RNP may help patients with diabetes to avoid risks during Ramadan fasting, such as hypoglycaemia, hyperglycaemia and dehydration.
- The RNP provides examples of meal plans within the target caloric levels, tailored for use in different countries.
- The RNP website is designed to capture menus from across the globe, that match the structure provided in this chapter.

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Ramadan nutrition plan (Algorithm 2)

Tool kit
Ramadan nutrition application for Egypt

Target daily calories	Macronutrient composition	Caloric distribution	1200 kcal/day	1500 kcal/day	1800 kcal/day	2000 kcal/day
1200 kcal *Weight reduction for women <150 cm tall*	• **CHO: 45–50%** Recommended: low GI, low GL, whole grain and high fibre • **Protein: 20–30%** Recommended: fish, skinless poultry, dairy, nuts, seeds and legumes • **Fat: <35%** Recommended: SFA <10%, choose low-fat cooking methods e.g. grill, bake and steam	**Suhoor** **30–40%**	**300–480 kcal** • Beans (Foul), *Ful:* 0.3 cup • Yoghurt: 1 tub • Cheese: 1 oz/1 slice • Small olives: 5 • Wholegrain bread: 1 thin slice • Tomato & cucumber salad, with 1 egg • Water/unsweetened drinks (430 kcal, CHO exchange = 3)[†]	**450–600 kcal** • Beans (Foul), *Ful:* 1 cup • Yoghurt: 1 tub • Cheese: 1 oz/1 slice • Small olives: 5 • Wholegrain bread: 1 thin slice • Tomato & cucumber salad, with 1 egg • Water/unsweetened drinks (500 kcal, CHO exchange = 3.5)	**540–720 kcal** • Beans (Foul), *Ful:* 1.5 cups • Yoghurt: 1 tub • Cheese: 2 oz/2 slices • Small olives: 5 • Wholegrain bread: 2 thin slices • Tomato & cucumber salad, with 1 egg • Water/unsweetened drinks (670 kcal, CHO exchange = 5)	**600–800 kcal** • Beans (Foul), *Ful:* 1.5 cups • Yoghurt: 1.5 tubs • Cheese: 2 oz/2 slices • Small olives: 10 • Wholegrain bread: 2 thin slices • Tomato & cucumber salad, with 1 egg • Water/unsweetened drinks (765 kcal, CHO exchange = 5.5)
1500 kcal *Weight maintenance for women <150 cm tall and weight reduction for women >150 cm tall*		**Snack 1[‡]** **10–20%**	**120–240 kcal** • Dates: 1–2* • Water/unsweetened drinks (60 kcal, CHO exchange = 1)	**150–300 kcal** • Dates: 1–2 • Water/unsweetened drinks (60 kcal, CHO exchange = 1)	**180–360 kcal** • Dates: 1–2 • Water/unsweetened drinks (60 kcal, CHO exchange = 1)	**200–400 kcal** • Dates: 1–2 • Water/unsweetened drinks (60 kcal, CHO exchange = 1)
1800 kcal *Weight maintenance for women >150 cm tall & weight reduction for men*	**Lifestyle recommendations** • Begin iftar with plenty of water to overcome dehydration from fasting • Keep physically active • Do not sleep for longer than usual	**Iftar** **40–50%**	**480–600 kcal** • Dates: 1–2* • Salad (tomatoes, cucumber & greens with lemon/vinegar dressing): 1 medium bowl • Soup (grilled or broiled chicken/ lentil/meat): 4 oz • Cooked vegetables: 1 cup • Rice (preferably wholegrain): 1 cup • Whole fruit: 1 small piece • Water/unsweetened drinks (600 kcal, CHO exchange = 4)	**600–750 kcal** • Dates: 1–2/fruit: 1 whole piece • Salad (tomatoes, cucumber & greens with lemon/vinegar dressing): 1 medium bowl • Soup (grilled or broiled chicken/ lentil/meat): 4 oz • Cooked vegetables: 1 cup • Rice (preferably wholegrain): 1 cup • Dessert: 1 small piece • Water/unsweetened drinks (700 kcal, CHO exchange = 5)	**720–900 kcal** • Dates: 1–2/fruit: 1 whole piece • Salad (tomatoes, cucumber & greens with lemon/vinegar dressing or olive oil dressing: 2 tsp): 1 medium bowl • Soup (grilled or broiled chicken/ lentil/meat): 4 oz • Cooked vegetables: 1.5 cups • Rice (preferably wholegrain): 1.5 cups • Dessert: 1 small piece • Water/unsweetened drinks (900 kcal, CHO exchange = 6)	**800–1000 kcal** • Dates: 1–2/fruit: 1 whole piece • Salad (tomatoes, cucumber & greens with lemon/vinegar dressing or olive oil dressing: 2 tsp): 1 medium bowl • Soup (grilled or broiled chicken/ lentil/meat): 4 oz • Cooked vegetables: 2 cups • Rice (preferably wholegrain): 1.5 cups • Dessert: 1 small piece • Water/unsweetened drinks (980 kcal, CHO exchange = 7)
2000 kcal *Weight maintenance for women >150 cm tall & for men*		**Snack 2** **10–20%**	**120–240 kcal** • Walnuts: 1 handful/GTSN: 3 tbsp • Water/unsweetened drinks (175 kcal, CHO exchange = 1)	**150–300 kcal** • Walnuts: 1 handful/GTSN: 6 tbsp • Water/unsweetened drinks (285 kcal, CHO exchange = 2)	**180–360 kcal** • Walnuts: 1 handful • Milk: 1 glass/GTSN: 6 tbsp • Water/unsweetened drinks (340 kcal, CHO exchange = 2)	**200–400 kcal** • Walnuts: 1 handful • Milk: 1 glass/GTSN: 6 tbsp • Water/unsweetened drinks (340 kcal, CHO exchange = 2)

Ramadan nutrition plan (Algorithm 2)

Tool kit
Ramadan nutrition application for Malaysia

Target daily calories	Macronutrient composition	Caloric distribution	1200 kcal/day	1500 kcal/day	1800 kcal/day	2000 kcal/day
1200 kcal *Weight reduction for women <150 cm tall*	• **CHO: 45–50%** Recommended: low GI, low GL, whole grain and high fibre • **Protein: 20–30%** Recommended: fish, skinless poultry, dairy, nuts, seeds and legumes • **Fat: <35%** Recommended: SFA <10%, choose low-fat cooking methods e.g. grill, bake and steam	**Suhoor** **30–40%**	**300–480 kcal** • Green salads/ulams: 1 cup • Stir-fried beans with egg: 0.5 cup • Wholegrain bread: 2 slices/ wholegrain rice: 1 cup (2 scoops) • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp)/unsweetened malted drink: 3 tbsp with milk • Water/unsweetened drinks (489 kcal, CHO exchange = 4.5)[†]	**450–600 kcal** • Green salads/*ulams:* 1 cup • Stir-fried beans with egg: 0.5 cup • Baked fish in sambal: 0.5 palm size • Wholegrain bread: 2 slices/ wholegrain rice: 1 cup (2 scoops) • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp)/unsweetened malted drink: 3 tbsp with milk • Water/unsweetened drinks (530 kcal, CHO exchange = 4.5)	**540–720 kcal** • Green salads/*ulams:* 1 cup • Stir-fried beans with egg: 1 cup • Baked fish in sambal: 1 palm size • Wholegrain bread: 2 slices/ wholegrain rice: 1 cup (2 scoops) • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp)/unsweetened malted drink: 3 tbsp with milk • Water/unsweetened drinks (650 kcal, CHO exchange = 5)	**600–800 kcal** • Dates: 1–2 • Green salads/*ulams:* 1 cup • Stir-fried beans with egg: 1 cup • Baked fish in sambal: 1 palm size • Wholegrain bread: 2 slices/ wholegrain rice: 1 cup (2 scoops) • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp)/unsweetened malted drink: 3 tbsp with milk • Water/unsweetened drinks (790 kcal, CHO exchange = 6)
1500 kcal *Weight maintenance for women <150 cm tall and weight reduction for women >150 cm tall*	**Lifestyle recommendations**	**Snack 1[‡]** **10–20%**	**120–240 kcal** • Dates: 1–2* • Baked chicken curry puff: 1 piece (medium size)/popiah basah: 1 piece/ pau ayam: 1 piece • Water/unsweetened drinks (175 kcal, CHO exchange = 2)	**150–300 kcal** • Dates: 1–2 • Baked chicken curry puff: 1 piece (medium size)/popiah basah: 1 piece/ chicken dumpling: 1 piece • Water/unsweetened drinks (175 kcal, CHO exchange = 2)	**180–360 kcal** • Dates: 1–2 • Baked chicken curry puff: 1 piece (medium size)/popiah basah: 1 piece/ chicken dumpling: 1 piece • Water/unsweetened drinks (175 kcal, CHO exchange = 2)	**200–400 kcal** • Dates: 1–2 • Baked chicken curry puff: 2 pieces (medium size)/popiah basah: 1.5 pieces/chicken dumpling: 1.5 pieces • Water/unsweetened drinks (275 kcal, CHO exchange = 3.5)
1800 kcal *Weight maintenance for women >150 cm tall & weight reduction for men*	• Begin iftar with plenty of water to overcome dehydration from fasting • Keep physically active • Do not sleep for longer than usual	**Iftar** **40–50%**	**480–600 kcal** • Dates: 1–2* • Green salads/*ulams:* 1 cup • Tempeh with anchovies: 1 cup • Lean grilled chicken in sambal: 1 palm size • Rice (preferably wholegrain/ parboiled basmati): 1 cup • Water/unsweetened drinks (525 kcal, CHO exchange = 3)	**600–750 kcal** • Dates: 1–2/fruit: 1 whole piece • Green salads/*ulams:* 1 cup • Tempeh with anchovies: 1 cup • Lean grilled chicken in sambal: 1 palm size • Low-fat soup with lean meat (1 matchbox) and vegetables: 1 small bowl • Rice (preferably wholegrain/ parboiled basmati): 1 cup • Water/unsweetened drinks (675 kcal, CHO exchange = 4)	**720–900 kcal** • Dates: 1–2/fruit: 1 whole piece • Green salads/*ulams:* 1 cup; olive oil: 1 tsp • Tempeh with anchovies: 1 cup • Lean grilled chicken in sambal: 1 palm size • Low-fat soup with lean meat (3 matchboxes) and vegetables: 1.5 small bowls • Rice (preferably wholegrain/ parboiled basmati): 1.5 cups • Water/unsweetened drinks (750 kcal, CHO exchange = 4.5)	**800–1000 kcal** • Dates: 1–2/fruit: 1 whole piece • Green salads/*ulams:* 1 cup; olive oil: 1 tsp • Tempeh with anchovies: 1 cup • Lean grilled chicken in sambal: 1 palm size • Low-fat soup with lean meat (4 matchboxes) and vegetables: 2 small bowls • Rice (preferably wholegrain/ parboiled basmati): 1.5 cups • Water/unsweetened drinks (800 kcal, CHO exchange = 5)
2000 kcal *Weight maintenance for women >150 cm tall & for men*		**Snack 2** **10–20%**	**120–240 kcal** • Milk: 1 glass/GTSN: 3 tbsp • Water/unsweetened drinks (125 kcal, CHO exchange = 1) OR • Wholegrain bread: 1 slice, with sardines and vegetables: 3 tbsp • Water/unsweetened drinks (160 kcal, CHO exchange = 1)	**150–300 kcal** • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp) • Water/unsweetened drinks (225 kcal, CHO exchange = 2) OR • Wholegrain bread: 2 slices, with sardines and green salads/vegetables • Water/unsweetened drinks (275 kcal, CHO exchange = 2)	**180–360 kcal** • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp) • Water/unsweetened drinks (225 kcal, CHO exchange = 2) OR • Noodle soup with meat: 1 small bowl, with green vegetables[‡] • Water/unsweetened drinks (350 kcal, CHO exchange = 3)	**200–400 kcal** • Milk: 1 glass, with oats: 3 tbsp (or GTSN: 6 tbsp) • Water/unsweetened drinks (225 kcal, CHO exchange = 2) OR • Noodle soup with meat: 1 small bowl, with green vegetables[‡] • Water/unsweetened drinks (350 kcal, CHO exchange = 3)

*If dates are consumed during snack 1, no dates should be consumed during iftar. [†]One CHO exchange = 15 g CHO. [‡]Increased consumption of green salad and vegetables is encouraged up to 3 cups daily; starchy vegetables should be measured (1 small potato = 1 exchange of CHO)

CHO, carbohydrate; GI, glycaemic index; GL, glycaemic load; GTSN, glycaemia-targeted specialised nutrition; SFA, saturated fatty acids; tbsp, tablespoon

Ramadan nutrition plan (Algorithm 2)

Tool kit
Ramadan nutrition application for South Africa

Target daily calories	
1200 kcal	*Weight reduction for women <150 cm tall*
1500 kcal	*Weight maintenance for women <150 cm tall and weight reduction for women >150 cm tall*
1800 kcal	*Weight maintenance for women >150 cm tall & weight reduction for men*
2000 kcal	*Weight maintenance for women >150 cm tall & for men*

Macronutrient composition

- **CHO: 45–50%** Recommended: low GI, low GL, whole grain and high fibre
- **Protein: 20–30%** Recommended: fish, skinless poultry, dairy, nuts, seeds and legumes
- **Fat: <35%** Recommended: SFA <10%, choose low-fat cooking methods e.g. grill, bake and steam

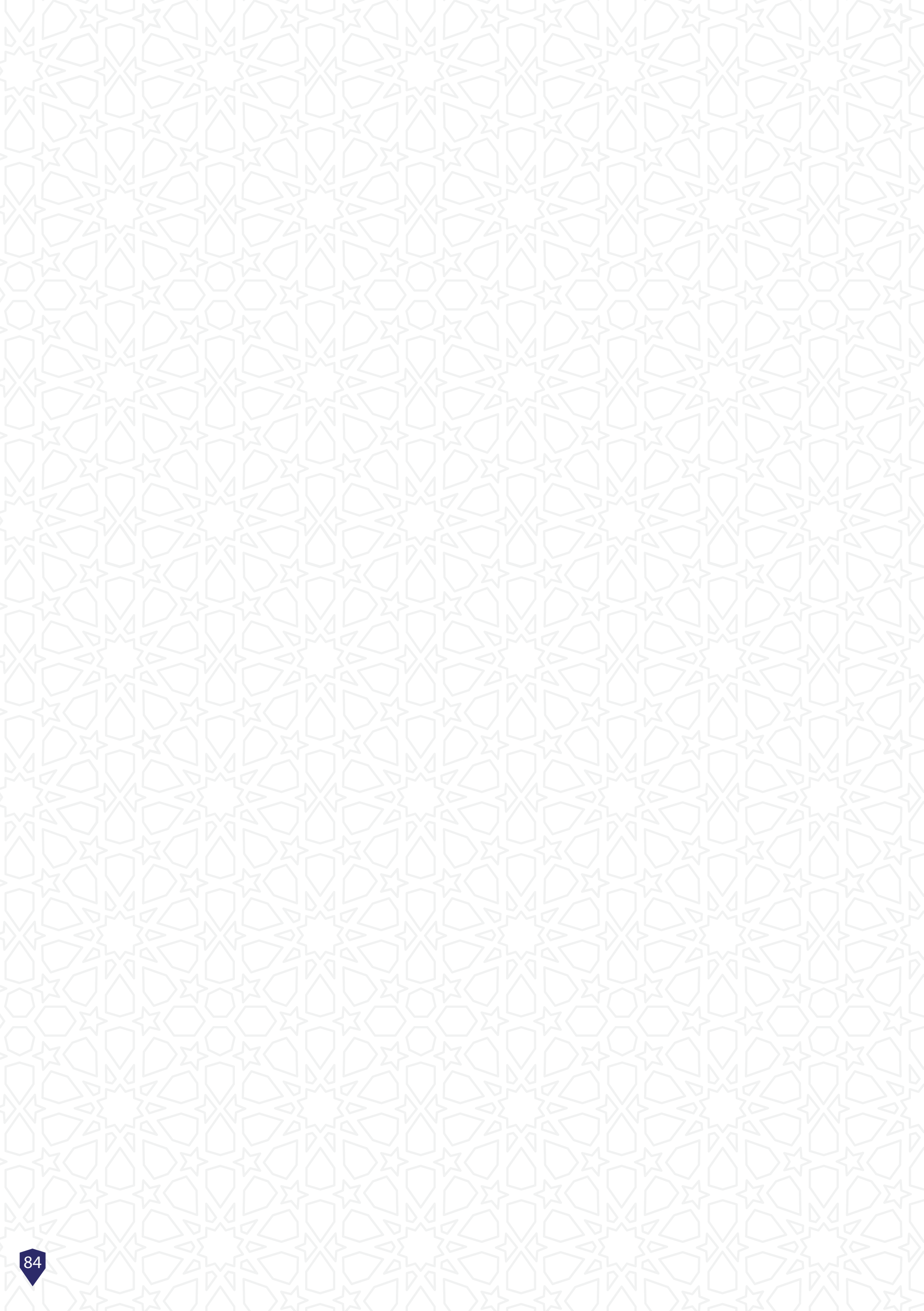
Lifestyle recommendations

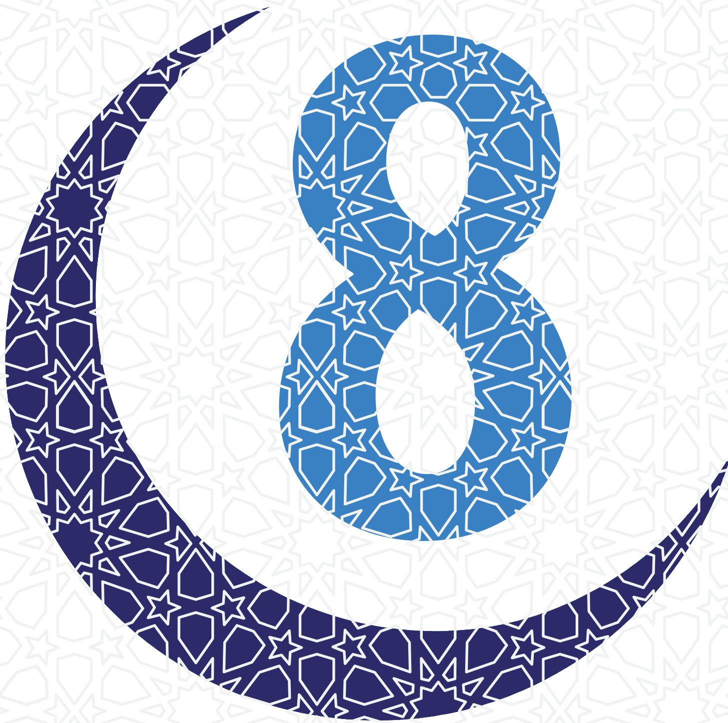
- Begin iftar with plenty of water to overcome dehydration from fasting
- Keep physically active
- Do not sleep for longer than usual

Caloric distribution	1200 kcal/day	1500 kcal/day	1800 kcal/day	2000 kcal/day
Suhoor 30–40%	**300–480 kcal** • Wholegrain bread: 1 slice, with egg: 1 large • Milk: 4 tbsp, with oats: 3 tbsp, and almonds: 0.5 handful • Apple: 1 small • Water/unsweetened drinks (400 kcal, CHO exchange = 3)[†]	**450–600 kcal** • Wholegrain bread: 2 slices, with egg: 1 large • Milk: 4 tbsp, with oats: 3 tbsp, and almonds: 0.5 handful • Apple: 1 small • Water/unsweetened drinks (475 kcal, CHO exchange = 4)	**540–720 kcal** • Wholegrain bread: 2 slices, with egg: 1 large • Milk: 4 tbsp, with oats: 3 tbsp, and almonds: 1 handful • Yoghurt: 0.5 tub • Apple: 1 small • Water/unsweetened drinks (555 kcal, CHO exchange = 4.5)	**600–800 kcal** • Wholegrain bread: 2 slices, with egg: 1 large • Milk: 4 tbsp, with oats: 6 tbsp, and almonds: 1 handful • Yoghurt: 0.5 tub • Apple: 1 small • Water/unsweetened drinks (640 kcal, CHO exchange = 5.5)
Snack 1 10–20%	**120–240 kcal** • Dates: 1–2* • Badam milk (milk, ground almonds: 0.5 handful and cardamom powder): 1 glass (210 kcal, CHO exchange = 2)	**150–300 kcal** • Dates: 1–2 • Badam milk (milk, ground almonds: 0.5 handful and cardamom powder): 1 glass (210 kcal, CHO exchange = 2)	**180–360 kcal** • Dates: 1–2 • Badam milk (milk, ground almonds: 0.5 handful and cardamom powder): 1 glass (210 kcal, CHO exchange = 2)	**200–400 kcal** • Dates: 1–2 • Badam milk (milk, ground almonds: 0.5 handful and cardamom powder): 1 glass (210 kcal, CHO exchange = 2)
Iftar 40–50%	**480–600 kcal** • Dates: 1–2* • Baked mince samosas: 2–3 cocktail • Haleem (wheat, oats and meat broth): 0.5 cup • Basmati/parboiled rice: 0.5 cup/ roti: 1 small • Grilled or curried lean chicken/fish: 4 oz • Green salad/vegetables[‡] • Water/unsweetened drinks (490 kcal, CHO exchange = 3)	**600–750 kcal** • Dates: 1–2 • Baked mince samosas: 2–3 cocktail • Haleem (wheat, oats and meat broth): 1 cup • Basmati/parboiled rice: 0.5 cup/ roti: 1 small • Grilled or curried lean chicken/fish: 4 oz • Green salad/vegetables • Water/unsweetened drinks (635 kcal, CHO exchange = 4)	**720–900 kcal** • Dates: 1–2 • Baked mince samosas: 2–3 cocktail • Haleem (wheat, oats and meat broth): 1 cup • Basmati/parboiled rice: 1 cup/ roti: 2 small • Grilled or curried lean chicken/fish: 4 oz • Green salad/vegetables • Water/unsweetened drinks (710 kcal, CHO exchange = 5)	**800–1000 kcal** • Dates: 1–2 • Baked mince samosas: 2–3 cocktail • Haleem (wheat, oats and meat broth): 1.5 cups • Basmati/parboiled rice: 1 cup/ roti: 2 small • Grilled or curried lean chicken/fish: 4 oz • Green salad/vegetables • Fruit: 1 whole piece • Water/unsweetened drinks (850 kcal, CHO exchange = 6)
Snack 2 10–20%	**120–240 kcal** • Unsweetened fruit in fruit juice: 0.5 cup • Water/unsweetened drinks (120 kcal, CHO exchange = 1)	**150–300 kcal** • Milk-based dessert with sweetener (phirmi/falooda/ras malai): 0.5 cup • Water/unsweetened drinks OR • Unsweetened fruit in fruit juice: 1 cup, and custard with sweetener: 0.5 cup • Water/unsweetened drinks (160 kcal, CHO exchange = 1.5)	**180–360 kcal** • Milk-based dessert with sweetener (phirmi/falooda/ras malai): 1 cup • Water/unsweetened drinks OR • Unsweetened fruit in fruit juice: 1 cup, and custard with sweetener: 0.5 cup • Water/unsweetened drinks (235 kcal, CHO exchange = 2.5)	**200–400 kcal** • Milk-based dessert with sweetener (phirmi/falooda/ras malai): 1 cup • Water/unsweetened drinks OR • Unsweetened fruit in fruit juice: 1 cup, and custard with sweetener: 0.5 cup • Water/unsweetened drinks (235 kcal, CHO exchange = 2.5)

*If dates are consumed during snack 1, no dates should be consumed during iftar. [†]One CHO exchange = 15 g CHO. [‡]Increased consumption of green salad and vegetables is encouraged up to 3 cups daily; starchy vegetables should be measured (1 small potato = 1 exchange of CHO)

CHO, carbohydrate; GI, glycaemic index; GL, glycaemic load; GTSN, glycaemia-targeted specialised nutrition; SFA, saturated fatty acids; tbsp, tablespoon





Chapter 8. Management of Diabetes during Ramadan

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8.1 Introduction

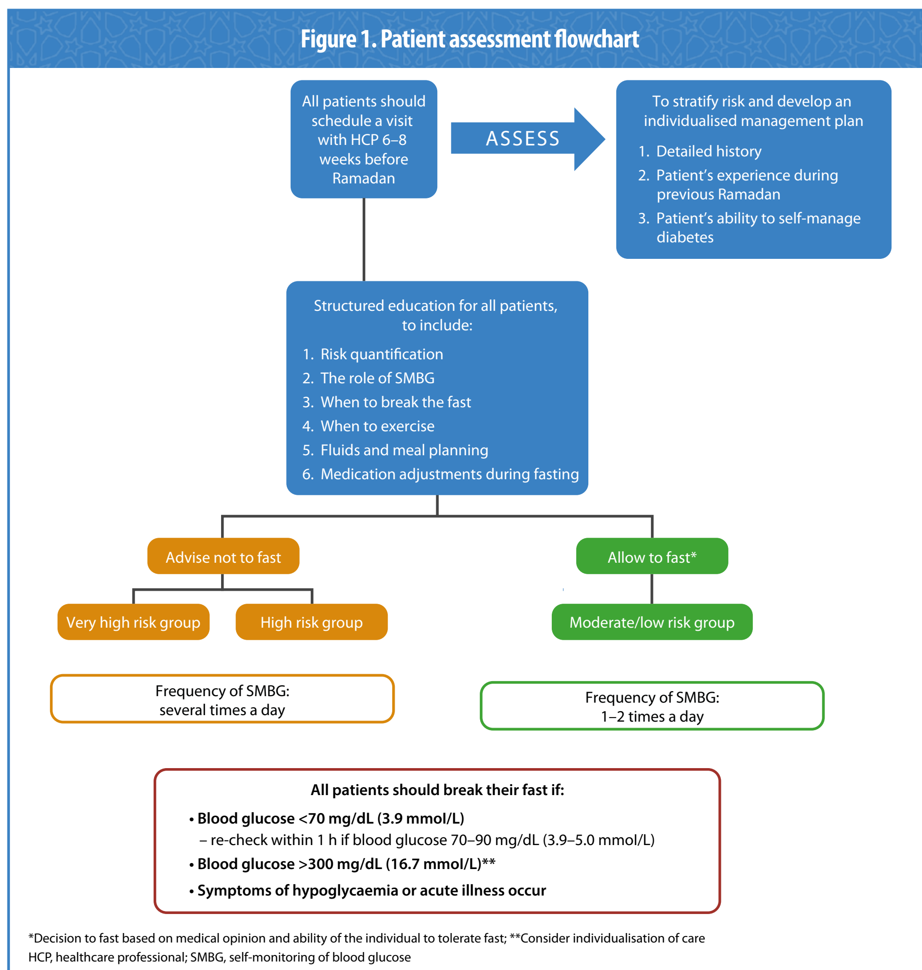
Due to the metabolic instability and change in lifestyle during the fasting and feasting hours, management of diabetes during Ramadan presents several challenges. One of the main concerns is the increased risk of hypoglycaemia. In general, anti-diabetic drugs that act by increasing insulin sensitivity and have extra-pancreatic effects have a significantly lower risk of hypoglycaemia than drugs that act by increasing insulin secretion [1]. Despite the risks, many people with diabetes will fast during this month. The majority of patients with type 2 diabetes mellitus (T2DM) can fast safely as long as appropriate medical advice is sought and followed prior to and during fasting. People with type 1 diabetes mellitus (T1DM) and pregnant women need special attention. Individualisation of treatment options is the proper approach for the management of diabetes during Ramadan [2, 3]. This process can be broken down into a number of steps involving pre-Ramadan patient assessment, medication adjustment during Ramadan and post-Ramadan follow-up.

8.2 Pre-Ramadan patient assessment

All patients with diabetes wishing to fast should have a pre-Ramadan assessment with a healthcare professional (HCP), ideally 6–8 weeks before the start of Ramadan. By taking a detailed medical history and reviewing the patient's glycaemic control, risk of hypoglycaemia and self-management capabilities, as well as other factors, the HCP can categorise the risk to the patient as very high, high or moderate/low and advise the patient to fast or not (***Figure 1***). Chapter 4 describes the risk stratification process in more detail. If the patient decides to fast, which may be against the advice of the HCP, an individualised management plan must be produced. An integral part of this is Ramadan-focused education (see Chapter 6), which should include information on diet, exercise, the frequency of self-monitoring of blood glucose (SMBG) levels and critically when to break the fast to avoid harm. Very high/high risk patients, such as those with T1DM, should perform SMBG multiple times during the day and further details can be found later in this chapter. Dietary information must be provided as Ramadan changes not only the timings of meals but often the types of food consumed. Chapter 7 describes the use of a Ramadan Nutrition Plan as a way to educate patients on the importance of diet during the holy month.

8.3 Medication adjustment

The type of medication the patient is taking for diabetes management influences the potential risks that fasting may cause and needs careful attention within the treatment plan. The following sections review the available evidence for the use of non-insulin and insulin anti-diabetic therapies during Ramadan in patients with T2DM and in those considered very high risk, for example people with T1DM and pregnant women, and uses it to generate evidence-based recommendations regarding treatment and any dose adjustments that may be required.

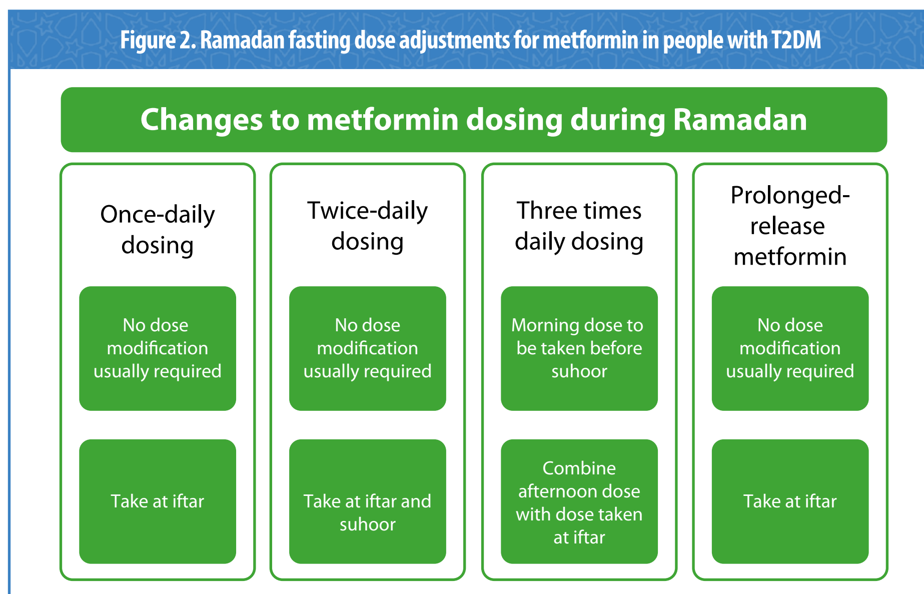


8.3.1 Pharmacological management of people with T2DM

Metformin

Metformin is the most commonly used first-line oral anti-diabetic drug (OAD) and works by preventing the liver from producing new glucose. It comes in an immediate-release preparation which may be taken up to three times a day and a prolonged-release formulation which is typically taken just once a day. Severe hypoglycaemia in non-fasting patients receiving metformin is rare and while there are no randomised controlled trials (RCTs) on metformin use in patients with T2DM during Ramadan, it is considered safe for individuals on metformin to fast because the likelihood of hypoglycaemia is low. Ramadan dose adjustments are shown in *Figure 2*.

Figure 2. Ramadan fasting dose adjustments for metformin in people with T2DM



Acarbose

Acarbose inhibits the actions of alpha-glucosidase, an enzyme that breaks down carbohydrates into glucose in the intestinal brush border, thereby slowing down the absorption of glucose and modifying insulin secretion. Like metformin, acarbose is typically introduced into treatment when healthy diet and exercise is not adequate for disease control. No dose adjustment of acarbose is needed during Ramadan as the risk of hypoglycaemia is low.



While no RCTs have been conducted on ACARBOSE in fasting patients with diabetes, NO DOSE MODIFICATION is considered necessary as the risk of hypoglycaemia is low

Thiazolidinediones

Thiazolidinediones (TZDs) improve insulin sensitivity of fat, muscle, liver and peripheral tissue cells by specifically activating the peroxisome proliferator-activated receptor-γ. This receptor is involved in glucose metabolism and activation by TZDs can increase glucose uptake, particularly in adipose tissue, subsequently lowering glucose in the blood [4]. As TZDs function without increasing insulin secretion, the risk of hypoglycaemia on TZD monotherapy in non-fasting individuals is very low [5]. Pioglitazone is the only TZD widely approved for use in T2DM but there are limited clinical data on its use during Ramadan. One study has evaluated the effects of

pioglitazone in addition to background OADs in 86 fasting Muslims during Ramadan (*Table 1*). Compared with placebo, pioglitazone significantly improved glycaemic control during the early, mid- and post-Ramadan periods. There was no difference in the number of hypoglycaemic events between the two treatment groups but a significant increase in weight of 3.02 kg was observed in the pioglitazone group compared with a non-significant loss in weight (-0.46 kg) in the placebo group [6].

Table 1. Studies evaluating TZD treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Pioglitazone	Vasan et al, 2006 [6]	n=86 *Study type:* Double-blind, randomised, controlled trial *Country:* India *Additional medication(s):* Oral anti-hyperglycaemic agents *Comparator:* Placebo	Events: Pioglitazone>placebo 39 vs 32 (p=0.21)	Fructosamine levels: Pioglitazone<placebo Early Ramadan: (p=0.003) Mid-Ramadan: (p=0.01) Post-Ramadan: (p=0.04)	Body weight: Pioglitazone: ↑3.02 kg (p=0.001) Placebo: ↓0.46 kg (p=0.37)

n, number of patients included in study

Due to the low risk of hypoglycaemia with PIOGLITAZONE, NO DOSE MODIFICATION is required during Ramadan and doses can be taken with iftar or suhoor

No adjustment to TZD medication is needed during Ramadan and doses can be taken with iftar or suhoor.

Short-acting insulin secretagogues

Short-acting insulin secretagogues such as repaglinide and nateglinide stimulate pancreatic β cells to secrete more insulin, and are usually taken before meals. In two small observational studies, no hypoglycaemic events were reported in patients treated with repaglinide during Ramadan [7, 8], while a third demonstrated no difference in hypoglycaemia when compared with insulin glargine or glimepiride, a sulphonylurea (SU) therapy [9]. Similarly, in two randomised parallel-group trials, a low incidence of hypoglycaemic events was associated with repaglinide treatment during Ramadan, occurring in similar proportions of patients treated with glibenclamide and glimepiride [10, 11].

Details of all studies are in ***Table 2***. Nateglinide use during Ramadan has not been reported, but as it has a faster onset and shorter duration of action than repaglinide, the risk of fasting hypoglycaemia is expected to be low [2].

Table 2. Studies evaluating repaglinide treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Repaglinide	Anwar et al, 2006 [10]	n=41 *Study type:* Open-label, parallel-group, randomised trial *Country:* Malaysia *Additional medication(s):* NR *Comparator:* SU (glimepiride)	Events: No significant difference between groups Symptomatic events during Ramadan: Repaglinide: 2.9%, Glimepiride: 3.5%	BG levels: Glimepiride <repaglinide	
	Bakiner et al, 2009 [7]	n=19 *Study type:* Observational *Country:* Turkey *Additional medication(s):* Insulin glargine *Comparator:* Non-fasting control group	Events: None reported in either group	No difference between the two groups	No significant weight changes in either group
	Cesur et al, 2007 [9]	n=65 *Study type:* Observational *Country:* Turkey *Additional medication(s):* Metformin *Comparators:* SU (glimepiride), insulin glargine, non-fasting control group	Patients experiencing event: No significant difference between fasting groups Glimepiride >repaglinide>insulin glargine 14.3% vs 11.1% vs 10.0% No severe episodes	No significant difference between fasting groups	No change in BMI in any fasting group Fasting did not adversely affect plasma lipids
	Mafauzy, 2002 [11]	n=235 *Study type:* Open-label, parallel-group, randomised trial *Countries:* France, Malaysia, Morocco, Saudi Arabia, UK *Additional medication(s):* None *Comparators:* SU (glibenclamide)	Patients experiencing event during Ramadan: Repaglinide: 7% Glibenclamide: 8% Ramadan midday BG <4.5 mmol/L: Repaglinide <glibenclamide 2.8% vs 7.9% ($p=0.001$)	Fructosamine levels: Repaglinide: significant ↓ from BL ($p<0.05$) Glibenclamide: no significant change No significant change in HbA1c in either group	

Table 2. Studies evaluating repaglinide treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Repaglinide	Sari et al, 2004 [8]	n=52 *Study type:* Observational *Country:* Turkey *Additional medication(s):* NR *Comparators:* SU (glimepiride or gliclazide); diet only	Events: None reported in repaglinide or diet-only groups 1 reported in SU group (glimepiride)	No significant change in repaglinide or SU groups Significant ↑ β-hydroxybutyric acid from BL: Diet only (p=0.034)	Significant ↓ triglyceride levels from BL: Repaglinide (p=0.024) SU (p=0.002) Significant ↑ HDL-cholesterol from BL: Repaglinide (p=0.022)

BG, blood glucose; BL, baseline; BMI, body mass index; HbA1c, glycated haemoglobin; HDL, high-density lipoprotein; n, number of patients included in study; NR, not reported; SU, sulphonylurea; UK, United Kingdom

The short duration of action of these agents make them appealing for use during Ramadan as they can be taken before iftar and suhoor and carry a low risk of hypoglycaemia.



The daily dose of SHORT-ACTING INSULIN SECRETAGOGUES (based on a three-meal dosing) may be REDUCED or REDISTRIBUTED to two doses during Ramadan according to meal size

Sulphonylureas

SUs are widely used as second-line treatment for T2DM after metformin and so there is a wealth of evidence and experience with this low cost efficacious drug class. SUs stimulate insulin secretion from pancreatic β cells in a glucose-independent process. Because of this, SUs are associated with a higher risk of hypoglycaemia compared with other OADs, which has raised some concerns about their use during Ramadan. However, this risk varies across medications within this class due to differing receptor interactions, binding affinities and durations of action. Studies that have evaluated SU treatment during Ramadan are outlined in *Table 3*.

In a multinational observational study of 1,378 patients with T2DM treated with SUs, approximately one fifth of patients experienced a symptomatic hypoglycaemic event during Ramadan. When this was broken down by drug, the highest incidence was associated with glibenclamide (25.6%) followed by glimepiride (16.8%) and gliclazide (14.0%) [12]. A similar outcome was observed in a large observational

Table 3. Studies evaluating SU treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
≥1 SUs ***(glibenclamide, gliclazide, glimepiride and/or glipizide)***	Aravind et al, 2011 [12]	n=1,378 *Study type:* Observational *Countries:* India, Israel, Malaysia, UAE, Saudi Arabia *Additional medication(s):* Metformin (not all patients) *Comparators:* NR	Symptomatic patients: Gliclazide <glimepiride <glibenclamide 14.0% vs 16.8% vs 25.6% Severe events: Gliclazide <glimepiride <glibenclamide 2.6% vs 5.1% vs 10.8%	NR	
	Aravind et al, 2012 [13]	n=870 *Study type:* Open-label, randomised, controlled trial *Countries:* India, Malaysia *Additional medication(s):* Metformin (not all patients) *Comparator:* DPP-4 inhibitor (sitagliptin)	Risk of symptomatic: Sitagliptin<SU (p=0.028) Patients experiencing symptomatic event: Sitagliptin<SU 3.8% vs 7.3% Breakdown of SU group: Gliclazide <glimepiride <glibenclamide 1.8% vs 5.2% vs 9.1%	NR	
	Al-Arouj et al, 2013 [14]	n=1,315 *Study type:* Observational *Countries:* Bangladesh, Egypt, India, Indonesia, Kuwait, Lebanon, Oman, Pakistan, Saudi Arabia, UAE *Additional medication(s):* Metformin (not all patients) *Comparator:* DPP-4 inhibitor (vildagliptin)	Patients experiencing ≥1 symptomatic event: Vildagliptin<SU 5.4% vs 19.8% (p<0.001) Breakdown of SU group: Glipizide<glimepiride <gliclazide <glibenclamide 12.5% vs 17.9% vs 19.2% vs 31.8% Confirmed by BG level (<3.9 mmol/L): Vildagliptin<SU 2.7% vs 12.9% Patients experiencing severe events: Vildagliptin<SU 0 vs 4 (p=0.053)	HbA1c change from BL: SU: ↑0.02% Vildagliptin: ↓0.24% (p<0.001 between treatments)	Body weight ↓: Vildagliptin>SU 0.76 kg vs 0.13 kg (p<0.001)

Table 3. Studies evaluating SU treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
≥1 SUs ***(glibenclamide, gliclazide, glimepiride and/or glipizide)***	Al Sifri et al, 2011 [15]	n=1,066 *Study type:* Open-label, randomised, controlled trial *Countries:* Egypt, Israel, Jordan, Lebanon, Saudi Arabia, UAE *Additional medication(s):* Metformin (not all patients) *Comparator:* DPP-4 inhibitor (sitagliptin)	Risk of symptomatic: Sitagliptin < SU ($p<0.001$) Patients experiencing symptomatic event: Sitagliptin < SU 6.7% vs 13.2% Breakdown of SU group: Gliclazide < glimepiride < glibenclamide 6.6% vs 12.4% vs 19.7%	NR	
Glibenclamide	Belkhadir et al, 1993 [16]	n=591 *Study type:* Randomised, controlled trial *Country:* Morocco *Additional medication(s):* NR *Comparators:* Reduced dose of usual glibenclamide; non-randomised, non-fasting control group	Events: No significant difference between groups	Fructosamine levels: No significant difference between groups HbA1c levels: No significant difference between groups	
	Mafauzy, 2002 [11]	n=235 *Study type:* Open-label, parallel-group, randomised trial *Countries:* France, Malaysia, Morocco, Saudi Arabia, UK *Additional medication(s):* None *Comparators:* Insulin secretagogue (repaglinide)	Patients experiencing event during Ramadan: Repaglinide: 7% Glibenclamide: 8% Ramadan midday BG <4.5 mmol/L: Repaglinide < glibenclamide 2.8% vs 7.9% ($p=0.001$)	Fructosamine levels: Repaglinide: significant ↓ from BL ($p<0.05$) Glibenclamide: no significant change No significant change in HbA1c in either group	
Glimepiride	Anwar et al, 2006 [10]	n=41 *Study type:* Open-label, parallel-group, randomised trial *Country:* Malaysia *Additional medication(s):* NR *Comparator:* Insulin secretagogue (repaglinide)	Events: No significant difference between groups Symptomatic events during Ramadan: Repaglinide: 2.9% Glimepiride: 3.5%	BG levels: Glimepiride < repaglinide	

Table 3. Studies evaluating SU treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Glimepiride	GLIRA Study Group, 2005 [17]	n=332 *Study type:* Observational *Countries:* Algeria, Egypt, Indonesia, Jordan, Lebanon, Malaysia *Additional medication(s):* NR *Comparator:* NR	Patients experiencing events during Ramadan: Newly-diagnosed: 3% Previously-treated: 3.7% Similar incidence in pre- and post-Ramadan periods	HbA1c pre-, at the start of and post-Ramadan: Newly-diagnosed: 9.2%, 7.7%, 7.1% Previously treated: 8.4%, 7.7%, 7.3%	
	Cesur et al, 2007 [9]	n=65 *Study type:* Observational *Country:* Turkey *Additional medication(s):* Metformin *Comparators:* Insulin secretagogue (repaglinide), insulin glargine; non-fasting control group	Patients experiencing event: No significant difference between fasting groups Glimepiride >repaglinide >insulin glargine 14.3% vs 11.1% vs 10.0% No severe episodes	No significant difference between fasting groups	No change in BMI in any fasting group Fasting did not adversely affect plasma lipids
Gliclazide	Hassanein et al, 2014 [18]	n=557 *Study type:* Double-blind, randomised controlled trial *Countries:* Denmark, Egypt, Germany, Indonesia, Jordan, Kuwait, Lebanon, Malaysia, Russia, Saudi Arabia, Singapore, Spain, Tunisia, Turkey, UAE, UK *Additional medication(s):* Metformin *Comparator:* DPP-4 inhibitor (vildagliptin)	Symptomatic: Vildagliptin<gliclazide 6.0% vs 8.7% (p=0.173) Confirmed events: Vildagliptin<gliclazide 3.0% vs 7.0% (p=0.039)	No significant change in either group	No significant difference in weight change between groups

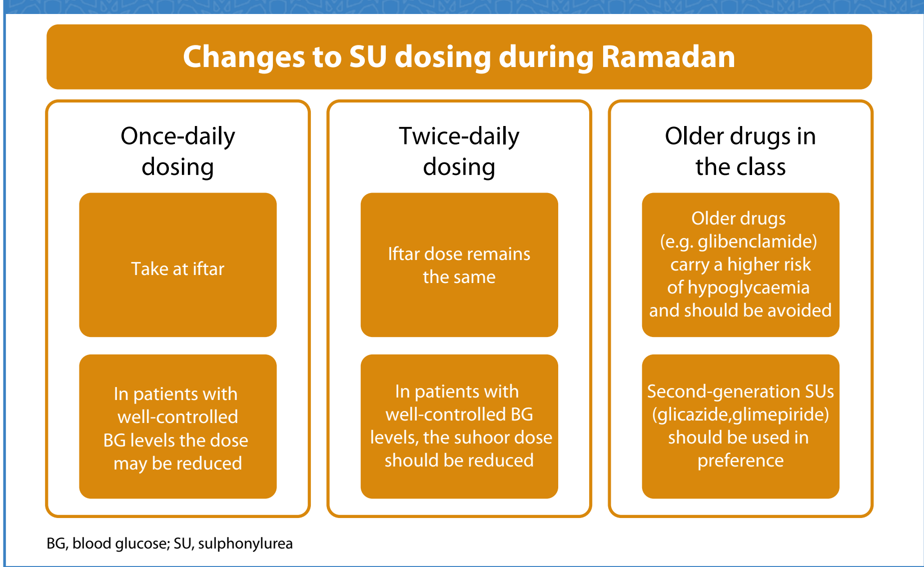
BG, blood glucose; BL, baseline; BMI, body mass index; DPP-4, dipeptidyl peptidase-4 inhibitor; HbA1c, glycated haemoglobin; n, number of patients included in study; NR, not reported; SU, sulphonylurea; UAE, United Arab Emirates; UK, United Kingdom

study comparing vildagliptin with SU treatment during Ramadan. Symptomatic hypoglycaemic events occurred in 31.8% of patients on glibenclamide but in fewer patients treated with gliclazide (19.2%), glimepiride (17.9%) or glipizide (12.5%) [14]. In addition, glibenclamide demonstrated significantly more hypoglycaemic events with midday blood glucose <4.5 mmol/L when compared to repaglinide (7.9% vs 2.8%, respectively; p=0.001) [11]. Lowering the dose of glibenclamide did not affect the

incidence of hypoglycaemic events [16]. More recent SUs such as glimepiride, glipizide and gliclazide are therefore preferred over conventional SUs, such as glibenclamide, because of their more favourable safety profile in terms of hypoglycaemia. In the large randomised trials comparing sitagliptin with SU treatment during Ramadan mentioned above, within the subgroups of patients that remained on gliclazide, the proportion of patients who experienced a hypoglycaemic event was comparable to the dipeptidyl peptidase-4 (DPP-4) inhibitor sitagliptin in the Al Sifri et al study (6.6% vs 6.7%, respectively) and less than sitagliptin in the Aravind et al study (1.8% vs 3.8%, respectively) [13, 15]. Similarly, no significant differences were observed in the proportions of patients reporting hypoglycaemic events treated with vildagliptin or gliclazide in the STEADFAST trial (6.0% vs 8.7%, respectively; p=0.173) [18].
To date, no trials have been conducted looking at the modified-release formulation of gliclazide during Ramadan. Incidence of hypoglycaemia is also low during Ramadan for glimepiride as shown in an open-label observational study where the incidence was just 3% in newly-diagnosed patients and 3.7% in previously treated patients, and was comparable to that observed before and after fasting [17]. Similarly, no significant differences in hypoglycaemic events were observed when glimepiride treatment was compared with either repaglinide or insulin glargine therapy [9, 10].

These studies demonstrate that patients with T2DM may continue to use second-generation SUs and fast safely during Ramadan. The use of older drugs within this class such as glibenclamide should be avoided in favour of gliclazide and glimepiride, which carry a much lower risk of hypoglycaemia. The use of these drugs should be individualised following clinician guidance and medication adjustments are outlined in ***Figure 3***.

Figure 3. Ramadan fasting dose adjustments for SUs in people with T2DM



BG, blood glucose; SU, sulphonylurea

Sodium-glucose co-transporter-2 (SGLT2) inhibitors

SGLT2 inhibitors including dapagliflozin, canagliflozin and empagliflozin, are the newest class of OADs. SGLT2 inhibitors have a unique mode of action whereby they increase excretion of glucose by the kidneys by reducing reabsorption in the proximal tubule, consequently decreasing blood glucose [19]. SGLT2 inhibitors have demonstrated effective improvements in glycaemic control and weight loss, and are associated with a low risk of hypoglycaemia. Because of this, it has been proposed that they provide a safe treatment option for patients with T2DM during Ramadan. However, certain safety concerns have been raised, such as an increase in some infections (urinary tract infections and genital mycotic infections) and a risk of ketoacidosis [19, 20]. An increased risk of dehydration in vulnerable patients has also been described, which may be a particularly pertinent issue during Ramadan. Currently, only one study has published data on the effectiveness of SGLT2 inhibitors during Ramadan (***Table 4***) [21].

Table 4. Studies evaluating SGLT2 inhibitor treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Dapagliflozin	Wan Juani et al, 2016 [21]	n=110 *Study type:* Open-label, randomised, 2-arm parallel-group study *Country:* Malaysia *Additional medication(s):* metformin *Comparator:* SU (glimepiride, gliclazide, or glibenclamide)	Events: Dapagliflozin<SU 6.9% vs 28.8% (p=0.002)	No significant differences in HbA1c, fasting BG, or fructosamine levels were observed between the groups	Postural hypotension: Dapagliflozin >SU 13.8% vs 5.8% (p=0.210) UTIs: Dapagliflozin >SU 10.3% vs 3.8% (p=0.277)

BG, blood glucose; HbA1c, glycated haemoglobin; n, number of patients included in study; SU, sulphonylurea; UTI, urinary tract infection

Patients with T2DM were randomised, in an open-label study, to receive either dapagliflozin or to continue with SU therapy. Significantly fewer patients in the dapagliflozin group reported hypoglycaemia than in the SU arm (6.9% vs 28.8%, respectively; p=0.002). Incidences of postural hypotension and urinary tract infections were greater in the dapagliflozin group than in the SU group, but did not reach significance [21]. Also, no increased risk of dehydration was evident with dapagliflozin treatment [22]. Further studies are warranted in order to prove the efficacy and safety

of SGLT2 inhibitors during Ramadan. A recent survey of physicians' views on the use of SGLT2 inhibitors during Ramadan for the treatment of patients with T2DM reported that the majority (70.6%) considered them suitable and safe for some patients [23]. Those that are deemed more at risk of complications such as the elderly, patients with renal impairment, hypotensive individuals, those at risk of dehydration or those taking diuretics should not be treated with SGLT2 inhibitors. Most of the physicians agreed that SGLT2 inhibitors should be taken with iftar and the importance of taking on extra fluids during the evening after a fast was highlighted [23].



SGLT2 inhibitors can be used with CAUTION in SOME patients. During Ramadan NO DOSE ADJUSTMENT is required and it is advised that the dose be taken with iftar

Dipeptidyl peptidase-4 (DPP-4) inhibitors

DPP-4 is an enzyme that rapidly metabolises glucagon-like peptide-1 (GLP-1), thereby regulating the activity of the hormone. By blocking this action, DPP-4 inhibitors effectively increase the circulating levels of GLP-1, which in turn stimulates insulin secretion in a glucose-dependent manner [24]. Currently available DPP-4 inhibitors include sitagliptin, vildagliptin, saxagliptin, alogliptin and linagliptin, which are administered orally once or twice a day and are considered one of the best-tolerated OADs with low risk of hypoglycaemia in non-fasting patients [2]. Four RCTs [13, 15, 18, 25] and five observational studies [14, 26-29] have examined the efficacy and safety of DPP-4 inhibitor treatment during Ramadan and are detailed in ***Table 5***.

Table 5. Studies evaluating DPP-4 inhibitor treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Sitagliptin	Al Sifri et al, 2011 [15]	n=1,066 *Study type:* Open-label, randomised, controlled trial *Countries:* Egypt, Israel, Jordan, Lebanon, Saudi Arabia, UAE *Additional medication(s):* Metformin (not all patients) *Comparator:* SU (glimepiride, gliclazide or glibenclamide)	Risk of symptomatic: Sitagliptin<SU (p<0.001) Patients experiencing symptomatic event: Sitagliptin<SU 6.7% vs 13.2% Breakdown of SU group: Gliclazide<glimepiride <glibenclamide 6.6% vs 12.4% vs 19.7%	NR	

Table 5. Studies evaluating DPP-4 inhibitor treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Sitagliptin	Aravind et al, 2012 [13]	n=870 *Study type:* Open-label, randomised, controlled trial *Countries:* India, Malaysia *Additional medication(s):* Metformin (not all patients) *Comparator:* SU (glimepiride, gliclazide or glibenclamide)	Risk of symptomatic: Sitagliptin<SU (p=0.028) Patients experiencing symptomatic event: Sitagliptin<SU 3.8% vs 7.3% Breakdown of SU group: Gliclazide<glimepiride <glibenclamide 1.8% vs 5.2% vs 9.1%	NR	
Vildagliptin	Al-Arouj et al, 2013 [14]	n=1,315 *Study type:* Observational *Countries:* Bangladesh, Egypt, India, Indonesia, Kuwait, Lebanon, Oman, Pakistan, Saudi Arabia, UAE *Additional medication(s):* Metformin (not all patients) *Comparator:* SU (glimepiride, gliclazide, glibenclamide or glipizide)	Patients experiencing ≥1 symptomatic event: Vildagliptin<SU 5.4% vs 19.8% (p<0.001) Breakdown of SU group: Glipizide <glimepiride<gliclazide <glibenclamide 12.5% vs 17.9% vs 19.2% vs 31.8% Confirmed by BG level (<3.9 mmol/L): Vildagliptin<SU 2.7% vs 12.9% Patients experiencing severe events: Vildagliptin<SU 0 vs 4 (p=0.053)	HbA1c change from BL: SU: ↑0.02% Vildagliptin: ↓0.24% (p<0.001 between treatments)	Body weight ↓: Vildagliptin>SU 0.76 kg vs 0.13 kg (p<0.001)
	Devendra et al, 2009 [26]	n=52 *Study type:* Observational *Country:* UK *Additional medication(s):* Metformin *Comparator:* SU (gliclazide)	Patients experiencing ≥1 event: Vildagliptin<gliclazide 7.7% vs 61.5% (p<0.001) Change in event incidence during Ramadan: Vildagliptin vs gliclazide: ↓0.24 vs ↑0.42 (p=0.0168)	HbA1c change: similar between groups	Between-treatment weight ↑: Vildagliptin: 0.34 kg (p=0.08) Gliclazide: 0.8 kg (p<0.001)

Table 5. Studies evaluating DPP-4 inhibitor treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Vildagliptin	Halimi et al, 2013 [27]	n=198 *Study type:* Observational *Country:* France *Additional medication(s):* Metformin *Comparators:* SU or glinide	Patients experiencing ≥1 symptomatic event: Vildagliptin<comparators 34.2% vs 37.2% (p=0.665) Vildagliptin<comparators 34.2% vs 37.2% (p=0.665) Confirmed by BG level: Vildagliptin<comparators 23.5% vs 30.8% (p=0.260) Patients experiencing ≥1 severe event and/or medical visit: Vildagliptin<comparators 2.6% vs 10.4% (p=0.029)	Stable and similar in both treatment groups	Weight was stable in both treatment groups Treatment modifications: Vildagliptin< comparators 28.3% vs 66.7% (p<0.001)
	Hassanein et al, 2011 [28]	n=59 *Study type:* Observational *Country:* UK *Additional medication(s):* Metformin *Comparator:* SU (gliclazide)	Events: Vildagliptin< gliclazide 0 vs 35 Patients experiencing events: Between-group difference: -41.7% (p=0.0002)	HbA1c: Between-group difference: -0.5% (p=0.0262) Gliclazide: ↑0.1% (p=0.540) Vildagliptin: ↓0.4% (p=0.059)	No significant changes in weight in either group Mean number of missed doses: Vildagliptin < gliclazide 0.2 vs 7.6
	Hassanein et al, 2014 [18]	n=557 *Study type:* Double-blind, randomised, controlled trial *Countries:* Denmark, Egypt, Germany, Indonesia, Jordan, Kuwait, Lebanon, Malaysia, Russia, Saudi Arabia, Singapore, Spain, Tunisia, Turkey, UAE, UK *Additional medication(s):* Metformin *Comparator:* SU (gliclazide)	Symptomatic: Vildagliptin <gliclazide 6.0% vs 8.7% (p=0.173) Confirmed events: Vildagliptin <gliclazide 3.0% vs 7.0% (p=0.039)	No significant change in either group	No significant difference in weight change between groups
	Malha et al, 2014 [25]	n=69 *Study type:* Open-label, randomised, controlled trial *Country:* Lebanon *Additional medication(s):* Metformin *Comparator:* SU (glimepiride, gliclazide)	Events: Vildagliptin<SU 19 vs 26 (p=0.334)	HbA1c change: similar between groups Vildagliptin: ↓ 0.83 % SU: ↓ 0.96%	Post-Ramadan BMI: Vildagliptin: ↓ from BL 28.8 vs 29.5 kg/m^2 SU: ↑from BL 29.8 vs 28.9 kg/m^2

Table 5. Studies evaluating DPP-4 inhibitor treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Vildagliptin	Shete et al, 2013 [29]	n=97 *Study type:* Observational *Country:* India *Additional medication(s):* Metformin (not all patients) *Comparator:* SU (glimepiride, gliclazide, glibenclamide or glipizide)	Patients experiencing events: Vildagliptin<SU 0% vs 4.8% (p=0.104)	HbA1c change from BL: SU: ↑0.01% (p=0.958) Vildagliptin: ↓0.43% (p=0.009) Patients achieving HbA1c <7.0%: Vildagliptin>SU 16.4% vs 4.8% (p=0.055)	Between-group weight ↓: Vildagliptin>SU 1.2 kg vs 0.03 kg (p<0.001)

BG, blood glucose; BL, baseline; BMI, body mass index; DPP-4, dipeptidyl peptidase-4; HbA1c, glycated haemoglobin; n, number of patients included in study; NR, not reported; SU, sulphonylurea; UAE, United Arab Emirates; UK, United Kingdom; USA, United States of America

Specifically, the four RCTs examined the effects of switching from SU therapy to either vildagliptin or sitagliptin prior to Ramadan compared with continuing on SU. The largest of these studies compared the incidence of self-reported hypoglycaemic events in 1,066 patients with T2DM treated with sitagliptin or SUs during Ramadan. Overall, the risk of hypoglycaemia significantly decreased on the sitagliptin-based regimen compared to continuing with SU treatment (relative risk ratio [95% CI] = 0.51 [0.34, 0.75]; p<0.001) [15]. A study in India and Malaysia reported similar results when the risk of experiencing hypoglycaemic symptoms was almost halved on a sitagliptin regimen compared with SUs (risk ratio [95% CI] = 0.52 [0.29, 0.94]; p=0.028) [13]. In both studies the incidence of hypoglycaemia with sitagliptin was similar to that of the SU gliclazide. In the multinational STEADFAST study, patients with T2DM were randomised to receive either vildagliptin or gliclazide (plus metformin) during Ramadan. Patients were switched to study drug at least 8 weeks prior to fasting and continued treatment for up to four weeks after Ramadan [18]. No significant difference in the reporting of any hypoglycaemic event was observed between the two groups. However, the proportion of patients experiencing at least one confirmed hypoglycaemic event during Ramadan was lower on vildagliptin versus gliclazide (3.0% vs 7.0%; p=0.039). Both glycaemic control and body weight remained stable throughout the study in both treatment arms.

A number of observational studies have demonstrated significantly lower incidences of hypoglycaemia with vildagliptin treatment versus SU during Ramadan (***Table 5***). One small study in the UK investigated the addition of vildagliptin or gliclazide to treatment regimens for the fasting period. Compared with before

Ramadan, vildagliptin treatment was associated with a reduction in the number of hypoglycaemic events during Ramadan while gliclazide was associated with an increase. Two patients (7.7%) in the vildagliptin group experienced hypoglycaemic events during Ramadan compared with 16 (61.5%) in the gliclazide group (p<0.001) [26]. Similar results were recorded in the VECTOR study; no self-reported hypoglycaemic events were reported in the vildagliptin group compared with 35 events in 15 patients (41.7%) in the gliclazide arm (including one severe event). In addition, the change in glycated haemoglobin (HbA1c) from baseline to post-Ramadan was significantly better in the vildagliptin group compared with the gliclazide group (p=0.0262) while body weight remained unchanged in both groups [28]. The French VERDI study compared the incidence of hypoglycaemic events during Ramadan in patients who received vildagliptin or an insulin secretagogue in addition to metformin. It found no significant difference in the number of patients experiencing at least one hypoglycaemic event [27]. However, the proportion of patients experiencing a severe hypoglycaemic event and/or an unscheduled medical visit due to hypoglycaemia was significantly lower in the vildagliptin group compared with the insulin secretagogue group (p=0.029) [27]. In India, a study found a significant reduction in HbA1c (-0.43%; p=0.009) and a higher proportion of patients achieving HbA1c <7.0% in patients treated with vildagliptin during Ramadan compared with a SU treated group. No hypoglycaemic events occurred in the vildagliptin group [29]. The VIRTUE study, conducted in the Middle East and Asia, is the largest of the observational studies to date and enrolled >1,300 patients with T2DM. Like the smaller studies, DPP-4 inhibitor treatment (vildagliptin) demonstrated significantly fewer patients with at least one hypoglycaemic event during Ramadan compared with those on SUs (5.4% vs 19.8%, respectively; p<0.001). Patients on vildagliptin also demonstrated significant reductions in HbA1c and body weight from baseline compared with those on SUs [14]. A recent meta-analysis of 16 RCTs and 13 observational studies in patients with T2DM who fasted during Ramadan has suggested that, when all relevant studies were taken into account, DPP-4 inhibitors were associated with the lowest incidence and rate of hypoglycaemic events compared with SUs [30]. Other more recently approved DPP-4 inhibitors (alogliptin, saxagliptin, and linagliptin) have yet to be studied during Ramadan.

The results of the studies described above indicate that vildagliptin is effective in improving glycaemic control and that both vildagliptin and sitagliptin are associated with low rates of hypoglycaemia during fasting, making them attractive treatment options during Ramadan. These drugs do not require any treatment modifications during Ramadan.



DPP-4 inhibitors do NOT REQUIRE TREATMENT MODIFICATIONS during Ramadan

Glucagon-like peptide-1 receptor agonists (GLP-1 RAs)

GLP-1 RAs mimic the incretin hormone and decrease glucose in the blood by increasing insulin secretion in a glucose-dependent manner. Like endogenous GLP-1, drugs in this class reduce glucagon secretion, increase glucose uptake and storage in muscle, decrease glucose production by the liver, reduce appetite and retard gastric emptying [24, 31]. As they act in a glucose-dependent manner, the risk of severe hypoglycaemia is low when used as monotherapy, but may still be an issue when given with SUs, glinides or insulin [2, 32]. A number of studies on the use of GLP-1 RAs during Ramadan have been published recently and details can be found in ***Table 6***.

Table 6. Studies evaluating GLP-1 RA treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Exenatide	Bravis et al, 2010 [33]	n=43 *Study type:* Observational *Country*: UK *Additional medication(s):* Metformin *Comparator:* SU (gliclazide)	Change in frequency of events: Exenatide: ↓0.08% ($p=0.43$) Gliclazide: ↑53.0% ($p=0.03$)	NR	Weight change: Exenatide: ↑0.12 kg ($p=0.55$) Gliclazide: ↑0.68 kg ($p=0.01$)
Liraglutide	Azar et al, 2015 [34]	n=343 *Study type:* Open-label, randomised, controlled trial *Countries:* Algeria, India, Israel, Lebanon, Malaysia, South Africa, UAE *Additional medication(s):* Metformin *Comparator:* SU	Symptomatic events during Ramadan: Liraglutide<SU ($p=0.0009$) Symptomatic events from BL to end of Ramadan: Liraglutide<SU ($p<0.0001$)	Fructosamine ↓ during Ramadan: Liraglutide similar to SU (despite better glycaemic control in liraglutide group at start of Ramadan) Fructosamine ↓ from BL to end of Ramadan: Liraglutide>SU ($p<0.05$) HbA1c (%) ↓ from BL to end of Ramadan: Liraglutide>SU ($p<0.0001$)	Body weight ↓ during Ramadan: Liraglutide>SU ($p=0.0091$) Body weight ↓: from BL to end of Ramadan: Liraglutide>SU ($p<0.0001$)
	Brady et al, 2014 [35]	n=99 *Study type:* Open-label, randomised, controlled trial *Country:* UK *Additional medication(s):* Metformin *Comparator:* SU (gliclazide, glipizide or glibenclamide)	Self-recorded episodes of BG ≤3.9 mmol/L: Liraglutide<SU ($p<0.0001$) No severe episodes	Change in HbA1c: 3 weeks post-Ramadan: Liraglutide>SU ↓0.54% vs ↓0.27% ($p=0.03$) 12 weeks post-Ramadan: Liraglutide>SU ↓0.32% vs ↑0.02% ($p=0.05$)	Body weight: 3 weeks post-Ramadan: Liraglutide>SU ↓2.23 kg vs ↓0.42 kg ($p=0.02$) 12 weeks post-Ramadan: Liraglutide>SU ↓2.57 kg vs ↑0.25 kg ($p=0.002$)

Table 6. Studies evaluating GLP-1 RA treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Liraglutide	Khalifa et al, 2015 [36]	n=111 *Study type:* Observational *Country:* UAE *Additional medication(s):* Insulin, SU, none *Comparator:* None	Patients experiencing events: 16.2% No severe hypoglycaemia	HbA1c post-Ramadan vs BL: 8.0% vs 7.4% (p=0.000)	

BG, blood glucose; BL, baseline; GLP-1 RA, glucagon-like peptide-1 receptor agonist; HbA1c, glycated haemoglobin; n, number of patients included in study; NR, not reported; SU, sulphonylurea; UAE, United Arab Emirates; UK, United Kingdom

The TREAT4 Ramadan trial examined the safety and efficacy of liraglutide compared to SU as add-on to metformin treatment in patients with T2DM in the UK during Ramadan [35]. The primary outcome was the proportion of patients who achieved a composite endpoint of HbA1c <7%, no weight gain and no severe hypoglycaemia 12 weeks post-Ramadan. While more patients achieved this endpoint in the liraglutide group compared with the SU group (26.7% vs 10.3%, respectively), this did not reach statistical significance. However, there was a significant reduction in HbA1c levels and body weight at both three and 12 weeks post-Ramadan in the liraglutide group compared with the SU group (***Table 6***) [35]. The incidence rate of self-recorded hypoglycaemic events was also significantly lower in the liraglutide group (p<0.0001) [35]. In the open-label LIRA-Ramadan study conducted in Africa and Asia, patients with T2DM were randomised to switch to once-daily liraglutide or continue on SU [34]. The primary endpoint was change in fructosamine from the beginning to end of Ramadan. Similar fructosamine reductions were observed in both cohorts despite better glycaemic control at the beginning of Ramadan in the liraglutide group. Significantly more patients in the liraglutide group reached the composite endpoint (HbA1c <7%, no weight gain, no hypoglycaemia) than in the SU group at the end of Ramadan (51.3% vs 17.7%; p<0.0001). Patients in the liraglutide arm also demonstrated better weight control and fewer confirmed hypoglycaemic episodes compared with the SU group [34]. The effects of adding liraglutide to pre-existing anti-diabetic regimens (including SU and insulin) during Ramadan was investigated in an observational trial in the United Arab Emirates [36]. No participants – 94.6% of whom were on SU, insulin or both – experienced a severe hypoglycaemic event during Ramadan, although 16.2% did develop symptoms of hypoglycaemia. A small but significant increase in HbA1c was observed following Ramadan [36]. A small observational study in patients with T2DM treated with exenatide in addition to metformin reported no significant differences in weight or hypoglycaemic episodes [33].

Data relating to the use of newer GLP-1 RAs (lixisenatide, dulaglutide and albiglutide) during Ramadan are lacking.

These studies demonstrate that liraglutide is safe as an add-on treatment to metformin and can be effective in reducing weight and HbA1c levels during Ramadan. Data on exenatide is limited to one study but the short duration of action and dosing of exenatide suggest that, like liraglutide, the risk of hypoglycaemia during Ramadan is low.



As long as GLP-1 RAs have been appropriately DOSE-TITRATED prior to Ramadan (6 weeks before), NO FURTHER TREATMENT MODIFICATIONS are required

Insulin treatment for T2DM

Insulin treatment for T2DM may include the use of a long/intermediate-acting basal insulin (insulin glargine, insulin detemir or neutral protamine Hagedorn [NPH] insulin), possibly with a rapid or short-acting bolus/pre-meal insulin (lispro, aspart or regular human insulin) [37], and may be used in conjunction with OADs. Insulin use during prolonged fasting carries an increased risk of hypoglycaemia, particularly for those with T1DM but also for those with T2DM. The use of insulin analogues is recommended over regular human insulin due to a number of advantages that include less hypoglycaemia [38]. Although a number of small randomised trials and observational studies (***Table 7***) have been conducted to assess some insulin regimens during Ramadan, large RCT data in this area are lacking.

Table 7. Studies evaluating insulin treatment in people with T2DM during Ramadan

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Basal insulin: glargine	Bakiner et al, 2009 [7]	n=19 *Study type:* Observational *Country:* Turkey *Additional medication(s):* insulin secretagogue (repaglinide) *Comparator:* Non-fasting control group	Events: None reported in either group	No difference between the two groups	No significant weight changes in either group

Table 7. Studies evaluating insulin treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Basal insulin: glargine	Cesur et al, 2007 [9]	n=65 *Study type:* Observational *Country:* Turkey *Additional medication(s):* Metformin *Comparators:* insulin secretagogue (repaglinide), SU (glimepiride), non-fasting control group	Patients experiencing event: No significant difference between fasting groups Glimepiride >repaglinide >insulin glargine 14.3% vs 11.1% vs 10.0% No severe episodes	No significant difference between fasting groups	No change in BMI in any fasting group Fasting did not adversely affect plasma lipids
	Salti et al, 2009 [39]	n=412 *Study type:* Observational *Countries:* Bangladesh, China, Egypt, India, Indonesia, Kuwait, Jordan, Lebanon, Malaysia, Morocco, Oman, Saudi Arabia, Tunisia, UAE *Additional medication(s):* SU (glimepiride), metformin/TZD (not all patients) *Comparator:* None	Events pre-, during and post-Ramadan: 156 vs 346 vs 153 Pre- vs. during Ramadan (p<0.001) Post- vs during Ramadan (p=0.0002)	No major change during Ramadan	Lower weight <70.0 kg (p=0.001) and waist circumference <90 cm (p=0.001) increased the risk of hypoglycaemia FBG >6.7 mmol/L (p<0.0001) decreased the risk of hypoglycaemia
Prandial insulin: lispro	Akram et al, 1999 [40]	n=68 *Study type:* Open-label, crossover, randomised trial *Countries:* Egypt, Kuwait, Pakistan, Saudi Arabia, UAE *Additional medication(s):* Humulin NPH (basal) *Comparator:* Soluble insulin (Humulin R)	Patients experiencing event: Similar for both treatment groups Events per patient per 14 days: Insulin lispro<soluble insulin 1.3% vs 2.6% (p<0.002) Total episodes in study: Insulin lispro<soluble insulin 22 vs 51 No severe episodes	↑ post-prandial BG (mmol/L): Insulin lispro <soluble insulin 1h: 3.0 vs 4.3 (p<0.01) 2h: 2.6 vs 4.0 (p=0.008)	

Table 7. Studies evaluating insulin treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Premixed insulin regimens					
Insulin lispro Mix 50 (evening) and human insulin Mix 30 (morning)	Hui et al, 2009 [41]	n=52 *Study type:* Observational *Country:* UK *Additional medication(s):* NR *Comparator:* Human insulin Mix 30 (twice-daily dosing)	Events: Insulin lispro Mix 50 and human insulin Mix 30: ↓0.04 (p=0.81) Human insulin Mix 30: ↑0.15 (p=0.43) Between-group difference not significant (p=0.36)	HbA1c change: Insulin lispro Mix 50 and human insulin Mix 30: ↓ 0.48% (p=0.0001) Human insulin Mix 30: ↑ 0.28% (p=0.007). Between-group difference (p=0.0004)	No significant difference in weight changes between groups
Insulin lispro Mix25	Mattoo et al, 2003 [42]	n=151 *Study type:* Open-label, crossover, randomised trial *Countries:* Egypt, India, Malaysia, Morocco, Pakistan, Singapore, South Africa *Additional medication(s)*: NR *Comparator:* Soluble insulin 30/70	Events per patient per 14 days: Similar for both treatment groups	Daily glycaemia (BG, mmol/L): Overall: Insulin lispro<soluble insulin 9.5 vs 10.1 (p=0.004) Pre-evening meal: Insulin lispro<soluble insulin 7.1 vs 7.5 (p=0.034) 2 hrs post-evening meal: Insulin lispro<soluble insulin 10.5 vs 11.6 (p=0.0001)	No significant change in body weight in any patient
Insulin detemir and biphasic insulin aspart	Shehadeh et al, 2015 [43]	n=245 *Study type:* Open-label, prospective, randomised controlled trial *Country:* Israel *Additional medication(s):* Metformin, SU (not all patients) *Comparator:* Standard care	Patients experiencing event: Intervention <standard care 4.8% vs 21.4% (p≤0.001)	Intervention was non-inferior to standard care	

Table 7. Studies evaluating insulin treatment in people with T2DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Biphasic insulin aspart	Soewondo et al, 2009 [44]	n=152 *Study type:* Observational *Country:* Indonesia *Additional medication(s):* Oral hypoglycaemic agents (not all patients) *Comparator:* None	Events: End of study<BL (not significant)	Biphasic aspart significantly reduced all glycaemic indices	No significant changes in body weight or BMI

BG, blood glucose; BL, baseline; BMI, body mass index; FBG, fasting blood glucose; HbA1c, glycated haemoglobin; n, number of patients included in study; NPH, Neutral Protamine Hagedorn; NR, not reported; SU, sulphonylurea; TZD, thiazolidinediones, UAE, United Arab Emirates; UK, United Kingdom

An observational study in patients with T2DM across 14 countries treated with insulin glargine plus glimepiride saw a significant increase in mild hypoglycaemic events during Ramadan compared with the pre-Ramadan period, and found that a lower weight and smaller waist circumference was associated with an increased risk [39]. Two smaller observational studies found insulin glargine safe to use during Ramadan with no significant increases in hypoglycaemia when compared with non-fasting individuals or when compared with those taking other OADs [7, 9]. Pre-meal administration of rapid or short-acting insulins may be required, in addition to long-acting basal insulin, to better control postprandial blood glucose. An open-label randomised trial by Akram et al compared the effects of two such insulins, rapid-acting analogue insulin lispro and short-acting soluble human insulin, taken before iftar during Ramadan. The postprandial rise in blood glucose levels after iftar and the rate of hypoglycaemia were both significantly lower in the lispro group [40]. Premixed insulins that combine short- and intermediate-acting insulins can be more convenient for patients with diabetes, as they require fewer injections than basal-bolus regimens, but may be associated with a higher risk of hypoglycaemia in non-fasting individuals [45, 46]. In an open-label randomised trial, the effects of two premixed insulin formulations (analogue insulin lispro Mix25 [25% short-acting lispro/75% intermediate-acting lispro protamine] and human insulin 30/70 [30% short-acting soluble human insulin/70% intermediate-acting NPH]) on glycaemic control were compared during Ramadan. Overall glycaemia was significantly lower for patients on insulin lispro Mix25 compared with patients on human insulin 30/70, with the greatest between-treatment difference evident before and after iftar. There was no difference in the number of hypoglycaemic episodes between treatments [42]. A regimen of premixed insulin lispro Mix50 (50% lispro/50% lispro protamine) in the evening and regular human insulin with NPH (30:70) in the morning was compared with regular human insulin with NPH (30:70) given twice daily during Ramadan in a small observational study. Switching the evening meal dose to insulin lispro Mix50 significantly improved glycaemic control without increasing the incidence of hypoglycaemic events [41]. A new regimen in which 40% of the daily

insulin dose was given as insulin detemir at suhoor and 60% was given as NovoMix70, a biphasic insulin aspart, before iftar was assessed in a recent randomised study. The new regimen was found to be non-inferior to standard care with a significantly lower hypoglycaemic event rate [43]. In addition, a prospective observational study in Indonesia found that compared to pre-Ramadan baseline levels, biphasic insulin aspart significantly reduced all glycaemic indices following Ramadan without an increase in body weight or risk of hypoglycaemia [44].

There are limited data available regarding the optimal insulin type or regimen for patients with T2DM during Ramadan but results from the studies described above indicate it may be safe to fast while on insulin, however treatment must be appropriately individualised. Recommended medication adjustments and SMBG-guided dose titrations for long/intermediate or short-acting insulin and premixed insulin can be found in ***Figures 4*** and ***5***, respectively.

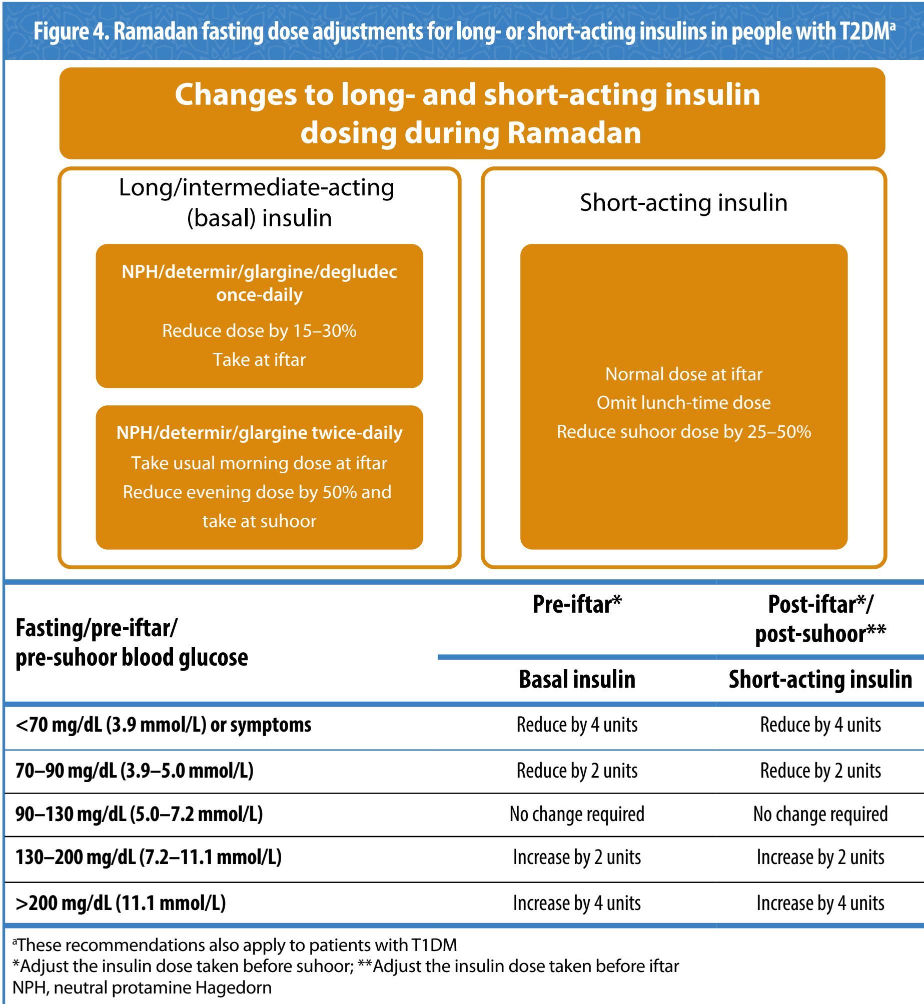


Figure 4. Ramadan fasting dose adjustments for long- or short-acting insulins in people with T2DM[a]

Fasting/pre-iftar/ pre-suhoor blood glucose	Pre-iftar*	Post-iftar*/ post-suhoor**
	Basal insulin	Short-acting insulin
<70 mg/dL (3.9 mmol/L) or symptoms	Reduce by 4 units	Reduce by 4 units
70–90 mg/dL (3.9–5.0 mmol/L)	Reduce by 2 units	Reduce by 2 units
90–130 mg/dL (5.0–7.2 mmol/L)	No change required	No change required
130–200 mg/dL (7.2–11.1 mmol/L)	Increase by 2 units	Increase by 2 units
>200 mg/dL (11.1 mmol/L)	Increase by 4 units	Increase by 4 units

[a]These recommendations also apply to patients with T1DM
*Adjust the insulin dose taken before suhoor; **Adjust the insulin dose taken before iftar
NPH, neutral protamine Hagedorn

Figure 5. Ramadan fasting dose adjustments for premixed insulin in people with T2DM[a]

Changes to premixed insulin dosing during Ramadan

Once-daily dosing	Twice-daily dosing	Three times daily dosing
Take normal dose at iftar	Take normal dose at iftar	Omit afternoon dose Adjust iftar and suhoor doses
	Reduce suhoor dose by 25–50%	Carry out dose-titration every 3 days (see below)

Fasting/pre-iftar/pre-suhoor blood glucose	Premixed insulin modification
<70 mg/dL (3.9 mmol/L) or symptoms	Reduce by 4 units
70–90 mg/dL (3.9–5.0 mmol/L)	Reduce by 2 units
90–126 mg/dL (5.0–7.0 mmol/L)	No change required
126–200 mg/dL (7.0–11.1 mmol/L)	Increase by 2 units
>200 mg/dL (11.1 mmol/L)	Increase by 4 units

Table modified from [47]. [a]These recommendations also apply to patients with T1DM

Patients with T2DM and poor glycaemic control despite multiple daily injections (MDI) of insulin can possibly benefit from an insulin pump system with continuous subcutaneous insulin secretion [48]. While there are no data for insulin pump use during Ramadan for T2DM, studies have demonstrated that adults and adolescents with T1DM can fast safely using insulin pumps.



Many patients with T2DM can fast safely during Ramadan but it is important for both HCPs and patients to understand and implement appropriate medication adjustments

8.3.2 Pharmacological management of high risk populations

Adults with T1DM

People with T1DM who fast can be at high risk of developing serious health problems [49]. Indeed, religious leaders, in unification with many diabetes experts, do not recommend fasting in individuals with T1DM, and such patients are categorised as very high risk (see Chapter 4) [50]. However, many patients with T1DM will choose to fast, especially those living in Muslim countries where the majority of the population is fasting; this unintentional peer pressure may make them want to behave similarly to their community.

A study assessing the incidence of diabetic ketoacidosis (DKA)-related hospital admissions during Ramadan and the month after (Shawal) found that DKA admission rates were higher in Ramadan compared to pre-Ramadan but the authors noted that a majority of the patients had poor glycaemic control before the start of fasting [51]. Although the risk of severe hypoglycaemic events seems to be low in fasting individuals, a study involving continuous glucose monitoring noted variable blood glucose levels and significant periods of hypoglycaemia that went unnoticed [52].

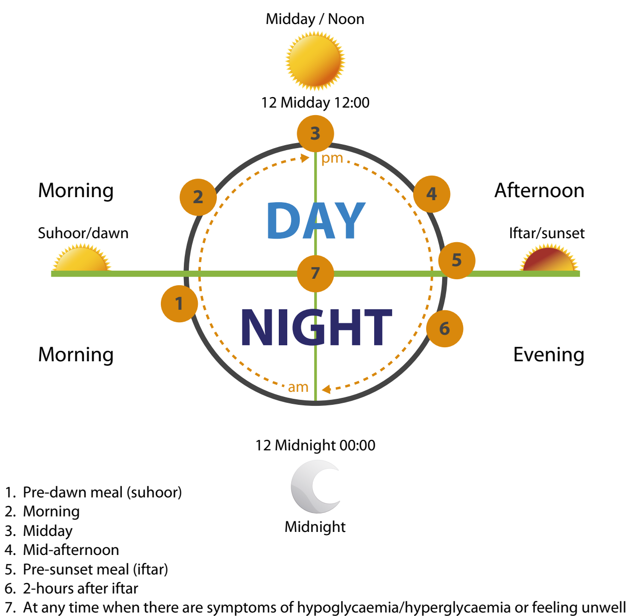
In general, patients with T1DM who have any of the following conditions are strongly advised not to fast [2, 49, 53]:

- History of recurrent hypoglycaemia
- Hypoglycaemia unawareness
- Poor diabetes control
- Brittle diabetes
- Non-compliance with medical treatment
- Patients who are 'unwilling' or 'unable' to monitor and manage their blood glucose levels.

Those who insist on fasting must be aware of all the potential risks associated with Ramadan fasting and be under close medical supervision [53]. Patients are advised to monitor their blood glucose several times during the day (***Figure 6***) and most importantly, levels should be checked at any time when symptoms of hypoglycaemia are recognised [47]. The post-meal test reduces the risk of postprandial hyperglycaemia [54]. The regularity of the blood glucose checks is dependent on the frequency of insulin treatment and/or the risk of hypo- or hyperglycaemia. To get a true understanding of how blood glucose changes while fasting, patients should be encouraged to keep a Ramadan logbook detailing the measurements [54]. All patients should comprehend the dangers of low and high blood glucose levels and

know to break the fast if blood glucose is <70 mg/dL (3.9 mmol/L) or >300 mg/dL (16.7 mmol/L) [2]. They should also be advised not to fast if they are unwell [2]. It must be stressed that performing a glucose blood test during the day does not violate the fast [54]. A study in Pakistan in 2010 involving 1,050 patients revealed that 28% thought a needle prick test was not allowed during fasting and 55% were unaware they should break the fast if glucose levels were low (60–70 mg/dL [3.3–3.9 mmol/L]), indicating that patient education is critical [55].

Figure 6. Recommended timings to check blood glucose levels during Ramadan fasting



1. Pre-dawn meal (suhoor)
2. Morning
3. Midday
4. Mid-afternoon
5. Pre-sunset meal (iftar)
6. 2-hours after iftar
7. At any time when there are symptoms of hypoglycaemia/hyperglycaemia or feeling unwell

Studies have shown that some patients with T1DM can tolerate fasting with no added risks of severe hypoglycaemia or DKA (*Table 8*) although adjustments to medication and/or dosing regimen may be required; however, it should be noted that periods of hypoglycaemia may go unrecognised [52].

Table 8. Studies evaluating insulin treatment in adults with T1DM during Ramadan					
Study drug	**Authors**	**Study details**	**Hypoglycaemia**	**Glycaemic control**	**Additional observations**
Insulin lispro	Kadiri et al, 2001 [56]	n=67 *Study type*: Open-label, randomised, crossover study *Countries:* Saudi Arabia, Kuwait, Pakistan, Egypt, Morocco *Additional medication(s):* intermediate-acting insulin (Humulin N) *Comparator:* Human insulin (Humulin R)	Events: Insulin lispro<human insulin 23.4% vs 48.4% (p=0.004)	↑ postprandial BG (mmol/L): Insulin lispro<human insulin 2h: 2.5 vs 3.5 (p=0.026)	
Ultralente	Kassem et al, 2005 [57]	n=17 *Study type:* Observational *Country:* Lebanon *Additional medication(s):* Regular insulin *Comparator:* None	No severe episodes	HbA1c: no change from before to after fasting	By end of Ramadan Ultralente dose was 70% of total insulin dose
Glargine	Mucha et al, 2004 [58]	n=15 *Study type:* Observational, non-Ramadan study *Country:* USA *Additional medication(s):* Rapid-acting insulin *Comparator:* None	Events: Fasting days<control days 2 vs 8 No severe episodes	Mean BG (mg/dL) on fasting day declined from 125±16 at 0700 to 93±11 at 1700 (p=0.055)	
Insulin pump therapy	Benbarka et al, 2010 [59]	n=49 *Study type:* Observational *Country:* UAE *Additional medication(s):* NR *Comparator:* None	Events: 17 patients had to break fast No severe episodes	↓ basal insulin rate: 47% by 5–50% Median reduction 14% ↓ serum fructosamine (mmol/L): pre-Ramadan 4.0±0.6 post-Ramadan 3.6±0.6 (p=0.007)	61.2% fasted the whole month 18.4% fasted 27–28 days 16.3% fasted 24–25 days 4.1% fasted 23 days

Table 8. Studies evaluating insulin treatment in adults with T1DM during Ramadan *(cont.)*

Study drug	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Insulin pump therapy	Khalil et al, 2012 [60]	n=21 *Study type:* Observational *Country:* UAE *Additional medication(s):* NR *Comparator:* None	No severe episodes	↓ basal insulin rate: During the day by 5–20% from before Ramadan ↑ basal insulin rate: During the night mean change in the overall amount of basal insulin was not significant A larger than usual amount of insulin bolus was given at meals	

BG, blood glucose; HbA1c, glycated haemoglobin; n, number of patients included in study; NR, not reported; UAE, United Arab Emirates

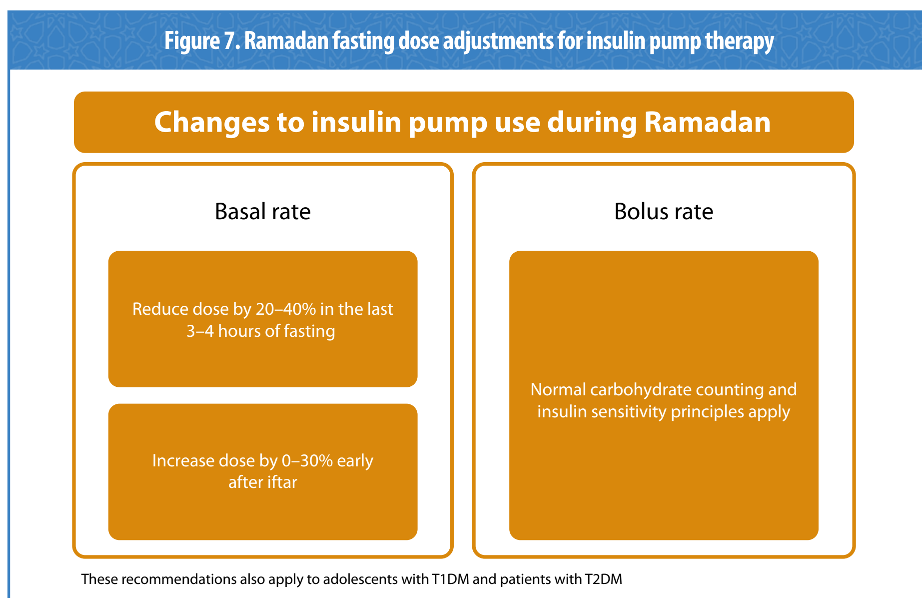
In a non-Ramadan study, patients taking the long-acting insulin, glargine, could fast safely for 18 hours with only mild hypoglycaemic episodes reported [58] and another study found that patients taking ultralente during Ramadan could fast without experiencing severe hypoglycaemic episodes [57]. Insulin lispro provided better glycaemic control and a lower incidence of hypoglycaemia than regular human insulin in a small randomised study [56]. The *South Asian Consensus Guideline: Use of insulin in diabetes during Ramadan* states that 'Once- or twice-daily injections of intermediate- or long-acting insulin along with pre-meal rapid-acting insulin is the management of choice' [61]. If patients with T1DM decide to fast then adjustments to insulin dose are recommended and can be found in ***Figures 4*** and ***5***.

More recent studies in patients using insulin pumps reported no cases of severe hypoglycaemia although some episodes of hypoglycaemia required the fast to be broken and adjustments to the basal rate were needed [59, 60]. Recommended dose adjustments for insulin pump therapy during Ramadan are outlined in ***Figure 7***.



The decision by an individual with T1DM to fast during Ramadan must be respected. There is some evidence to suggest that, as long as they are otherwise stable and healthy, they can do so safely. However, strict medical supervision and focused education on how to control their glycaemic levels is essential

Figure 7. Ramadan fasting dose adjustments for insulin pump therapy



Young adults/adolescents with T1DM

Once a child reaches puberty they are expected to fast during Ramadan. Care for adolescents with T1DM, particularly in Ramadan, should be restricted to experts in the management of diabetes in this age group. There have been a number of studies, albeit with a limited number of patients, that have investigated fasting in adolescents with T1DM (***Table 9***) and the general consensus is that only some can fast safely if they have good hypoglycaemia awareness, good glycaemic control pre-Ramadan, have the knowledge and willingness to SMBG levels, are able to adjust medication as needed and are carefully supervised by an expert physician. As with adults, adolescents with T1DM who decide to fast (and their parents) must be aware of all potential risks associated with Ramadan fasting. Frequent blood glucose monitoring, observing the breaking fasting rules and avoiding fasting on 'sick days' are all essential to avoid complications [62]. Children and adolescents on a conventional twice-a-day regimen should take their usual morning dose before iftar and short-acting insulin at suhoor [63, 64]. Recommended dose adjustments for adolescents on MDI are outlined in ***Figure 8***. For those using insulin pumps the changes to dose are the same as those for adults (***Figure 7***).



As with adults, adolescents with T1DM who decide to fast (and their parents) must be aware of all potential risks associated with Ramadan fasting

Table 9. Studies evaluating insulin regimens in adolescents with T1DM during Ramadan

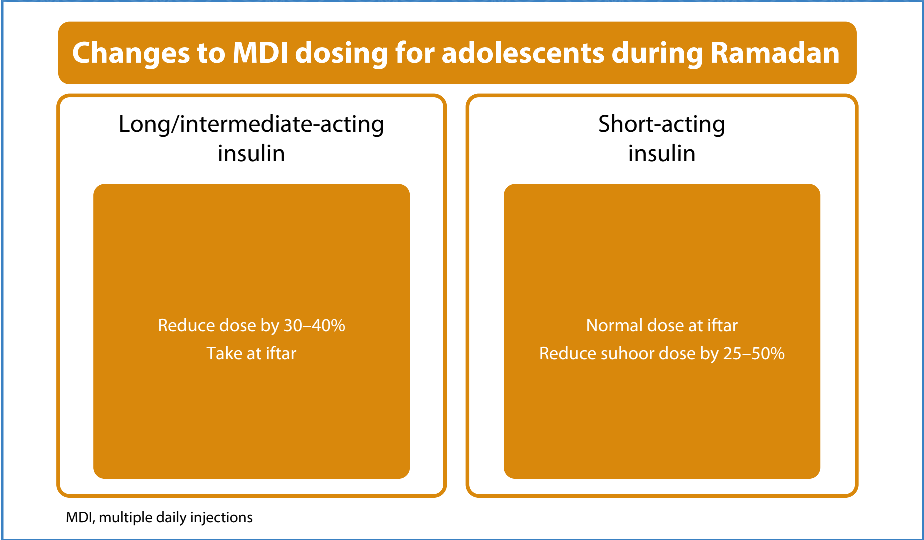
Insulin regimen	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Insulin (conventional BID regimen)	Zabeen et al, 2014 [64]	n=33 *Study type:* Observational *Country:* Bangladesh *Additional medication(s):* NR *Comparator:* None	Events: 2 patients from group I (those that completed fast; n=20) 3 patients from group II (those that broke fast; n=13) No severe episodes	Mean HbA1c pre-Ramadan vs post-Ramadan: Group I, 8.5% vs 8.1% Group II, 8.9% vs 9.4%	No significant change in body weight
	Al-Khawari et al, 2010 [63]	n=22 *Study type:* Observational *Countries:* UK, Kuwait *Additional medication(s):* NR *Comparator:* MDI	Events: BID<MDI 44% vs 61.5%	NR	↑ weight: 91% patients by 1–2 kg regardless of insulin regimen
Insulin (MDI)	AlAlwan et al, 2010 [65]	n=20 *Study type:* Observational *Country:* Saudi Arabia *Additional medication(s):* NR *Comparator:* Non-fasting group (n=8)	1 child in fasting group (n=12) withdrew due to hypoglycaemia	HbA1c pre-Ramadan vs post-Ramadan: Fasting group, 10.4% vs 10.4% Non-fasting group, 10.6% vs 10.4%	No significant change in body weight
Insulin pump	Bin-Abbas, 2008 [66]	n=9 *Study type:* Observational *Country:* Saudi Arabia *Additional medication(s):* NR *Comparator:* Conventional BID regimen	Events per patient per month: Pump<BID 16 vs 29 ($p<0.002$) No severe episodes	Mean HbA1c: Pump<BID 7.8% vs 9.1% ($p<0.001$)	

Table 9. Studies evaluating insulin regimens in adolescents with T1DM during Ramadan *(cont.)*

Insulin regimen	Authors	Study details	Hypoglycaemia	Glycaemic control	Additional observations
Insulin pump or glargine plus short-acting insulin	Kaplan & Afandi, 2015 [52]	n=21 *Study type:* Observational *Country:* UAE *Additional medication(s):* NR *Comparator:* None	Hypoglycemia (<70 mg/dL [3.9 mmol/L]) was observed in 14.2% of the fasting hours and 2.5% of the eating hours ($p<0.05$) Episodes of unreported hypoglycaemia observed	Large fluctuations in BG during fasting and eating hours were noted	Patients were able to fast for a majority (85%) of the days; 76% fasted ≥25 days Hyperglycemia (>300 mg/dL [16.7 mmol/L]) was observed in 12% of the fasting hours and 17% of the eating hours ($p<0.05$)

BG, blood glucose; BID, twice-a-day; CGM, continuous glucose monitor; HbA1c, glycated haemoglobin; MDI, multiple daily injections; n, number of patients included in study; NR, not reported; UAE, United Arab Emirates

Figure 8. Ramadan fasting dose adjustments for MDI therapy in adolescents with T1DM



MDI, multiple daily injections

Management in pregnancy

Fasting during pregnancy has always been a contentious issue. All pregnant women have the option not to fast if they are worried about either their health or that of their foetus. However, many do decide to participate as they feel guilty if they do not [67, 68]. If a pregnant woman elects not to fast she will be expected to make up missed days once the baby has been born, presumably at a time when others within the family are not

fasting. Fasting alone is challenging and this may deter pregnant women from obtaining the exemption [68, 69]. In fact, evidence from some countries suggests that the majority of pregnant women (70–90%) do observe the fast [70], although surveys suggest that they may not manage the full month [67, 71, 72]. This is despite the fact that pregnant women with diabetes are considered very high risk and are advised not to fast during Ramadan [2, 49, 50].



Pregnant women with diabetes are stratified as VERY HIGH RISK with a high probability of harm and are advised NOT to fast

Some studies in healthy pregnant women, with no diabetes, have shown no harmful effects of fasting on baby or mother [71, 73-75], although one study found that low birth weight was 1.5-times more likely in women who were in the first trimester when they fasted compared with non-fasting mothers [76]. Other studies have also demonstrated detrimental effects. Decreased placental weight was observed in women who were in second and third trimester when they fasted although birth weight was unaffected [77]. The authors suggested that this may have an effect on foetal programming with long-term health implications [77]. Data from Uganda and Iraq suggest a possible link between prenatal exposure to Ramadan and learning disabilities in adulthood [70]. With such discrepancies in the literature and the religious licence for women not to fast during pregnancy, it is perhaps not surprising to find that at present there is a consensus to categorise pregnant women as high risk, until further evidence is available. However, fasting during pregnancy is an important personal decision and a practical approach would be to explain the potential effects on mother and foetus, thereby empowering the patient with knowledge and education regarding self-management skills for good pregnancy outcomes. Women with gestational diabetes who are well-controlled pre-Ramadan on diet or metformin are at lower risk of hypoglycaemia. The risk of postprandial hyperglycaemia however still exists. If they insist on fasting then they should aim at achieving postprandial glucose targets and they should be managed by an expert team. However, patients on SU therapy and/or insulin should be strongly advised against fasting due to the higher risk of hypoglycaemia. Modifications to diet and insulin regimens such as those outlined for patients with T1DM will be required in conjunction with frequent blood glucose monitoring, focused education and strict medical supervision.



Fasting during pregnancy is an important personal decision. A practical approach would be to explain the potential effects on mother and foetus thereby empowering the patient with knowledge and education regarding self-management skills for good pregnancy outcomes

8.4 Post-Ramadan follow-up

Eid ul-Fitr, a 3-day festival, marks the end of Ramadan and patients with diabetes should be made aware of the risks of overindulgence during this time. A post-Ramadan follow-up meeting with HCPs is advisable in order to discuss medication and regimen readjustments and assess how the patient handled the fasting. It should be stressed to the patient that a safe fast one year does not automatically make them a low risk for the next year due to the progressive nature of the disease.

Summary

- A pre-Ramadan assessment is vital for any patient with diabetes who intends to fast in order to evaluate the risks, educate the patient in self-management of the condition during Ramadan and to produce a patient-specific treatment plan.
- With the correct advice and support from HCPs most people with T2DM can fast safely during Ramadan.
- Patients taking metformin, short-acting insulin secretagogues, SUs or insulin will need to make adjustments to dose and or timings to reduce the risk of hypoglycaemia while maintaining good glycaemic control.
- Newer OADs including incretin-based therapies are associated with a lower risk of hypoglycaemia and may be preferable for use during Ramadan.
- SGLT2 inhibitors are probably safe but should be used with caution in some patients. More data regarding the use of SGLT2 inhibitors during Ramadan are required.
- Patients classified as very high/high risk including T1DM and pregnant women with diabetes need close medical supervision and focused Ramadan-specific education if they insist on fasting.
- A post-Ramadan follow-up consultation is recommended.

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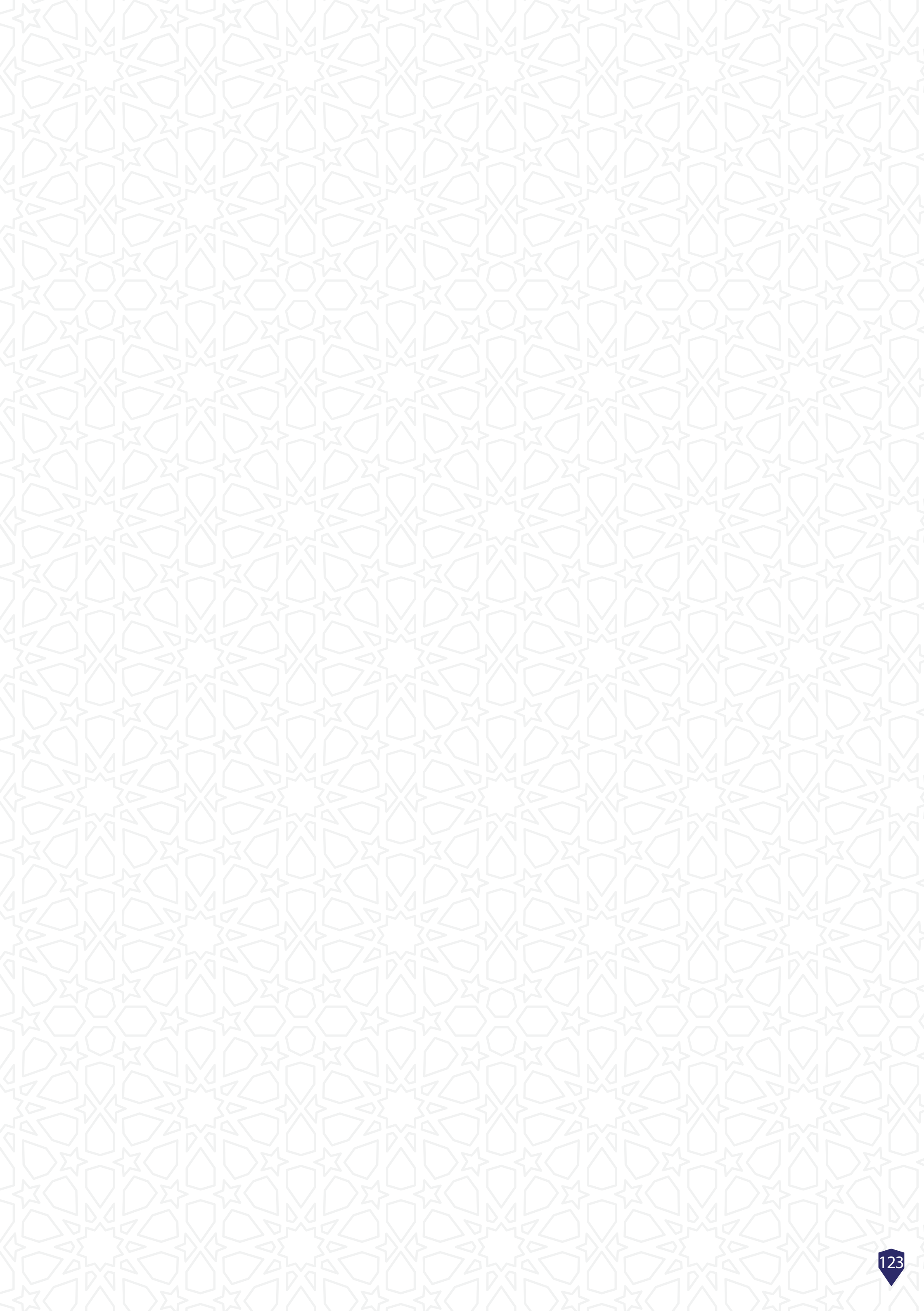
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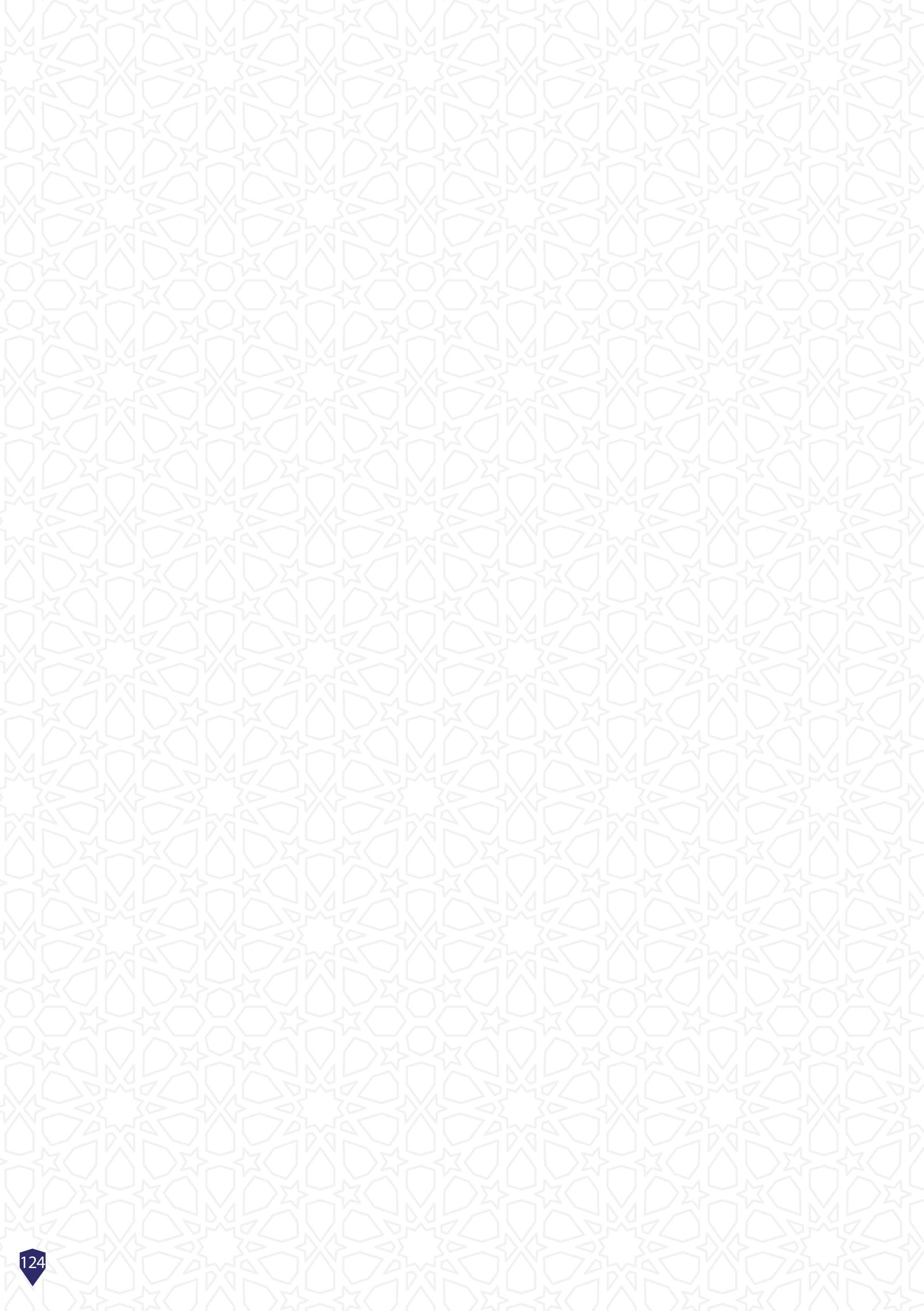
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Chapter 9. Identifying and Overcoming Barriers to Guideline Implementation

Mesbah Sayed Kamel, Sulaf Ibrahim Abdelaziz, Mohamed Hassanein, Mohamed Sandid, Line Kleinebreil & Adel A El-Sayed

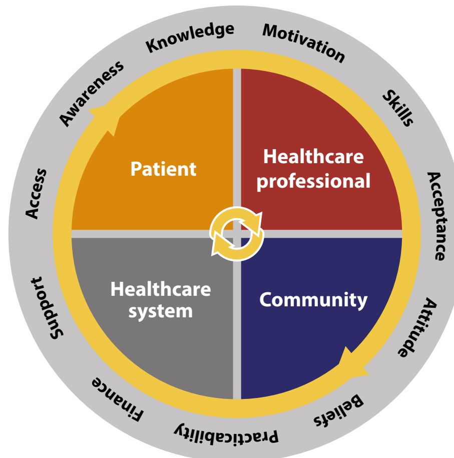
9.1 Introduction

Diabetes is a chronic disease requiring continuous management [1]. Optimal management relies on the patient and healthcare professional (HCP) working closely together to control the patient's blood glucose levels and reduce diabetes-associated risks. For the patient, this involves lifestyle changes, glucose monitoring and (in many cases) pharmaceutical interventions [1]. Patient self-management is therefore key, and a supportive healthcare service is necessary to facilitate this. A number of global and national guidelines for the management of diabetes have been created to aid effective disease management and to provide standards of care [1-4]. Furthermore, awareness of socio-cultural circumstances that may impact on diabetes management has increased. For example, several recommendations for the management of diabetes during the fasting period of Ramadan have been developed recently, along with educational programmes [5-7]. However, guidelines and educational resources, including the *IDF-DAR Practical Guidelines* presented in this booklet, are only of value if they are adhered to. Several barriers to guideline implementation have been identified across Muslim communities, in both Muslim-majority and Muslim-minority countries.

9.2 Identifying barriers to guideline implementation

Barriers may arise on an individual level (e.g. within the patient or HCP), or may originate within the wider cultures of the community or healthcare system (*Figure 1*).

Figure 1. Barriers to guideline implementation span patients, healthcare professionals, healthcare systems and communities



Modifying established behaviour to achieve guideline recommendations is difficult; it can require changing personal beliefs and practices, as well as reshaping complex

relationships within health services and within communities. A full understanding of these issues is critical for tailoring practical solutions. Some of the barriers to diabetes guideline implementation in Muslim communities, particularly during Ramadan, will be outlined below, alongside suggested strategies for overcoming them.

9.2.1 Community and patient barriers

Injections and skin pricks

It is believed by some Muslim communities that injecting insulin invalidates Ramadan fasting. Many also feel that pricking the skin, an integral part of the blood glucose test, breaks the fast [8]. In a retrospective observational study of glucose testing during Ramadan, 860 patients with diabetes were surveyed in Pakistan [8]. The survey revealed that 39.8% of respondents who were taking insulin for their diabetes did not perform blood glucose tests during Ramadan, as they felt it would void the fast [8]. Even outside of Ramadan, regular monitoring of blood glucose is insufficiently practised by patients with diabetes in some Muslim communities [9]. Hence, educating all people with diabetes through available educational channels that insulin injection and/or blood glucose monitoring does not invalidate fasting during Ramadan is essential.



In the majority of Muslim countries, blood glucose testing and/or insulin injection does not invalidate the Ramadan fast

Diet and exercise

Consumption of a high-fat and high-protein diet during Ramadan is a traditional behaviour that can be difficult to modify [10]. A prospective study of the dietary patterns of patients with type 2 diabetes (T2DM) during Ramadan, who also underwent dietary counselling, revealed an increase in calorie intake during Ramadan with a significant increase in fat intake [10]. The study demonstrated that despite repetitive counselling on diet guidelines for Ramadan, compliance was poor [10]. This was also noted in the CREED study where 30% of patients reported eating larger meals [11]. Following a day of fasting, as well as a desire to eat larger than normal meals, there is often an urge to eat them more quickly. Eating rate has been positively correlated with food intake, and eating too quickly can lead to overconsumption [12]. Eating habits, such as the number and timing of meals, also varies among countries, and this can impact on the management of diabetes and the relevance of guidelines. For example, in some countries the fast is broken with a light snack followed by a large meal later in the evening, whereas in others a main meal is used to break the fast. Increased exercise is also an important lifestyle modification

for people with diabetes but this might be avoided in some Muslim communities, both due to practical considerations such as lack of time and services, as well as cultural circumstances and social expectations [13].

9.2.2 Barriers involving HCPs and healthcare systems

Barriers to guideline implementation originating among HCPs can arise from numerous factors, including a lack of skills, knowledge, cultural competence and awareness of patient needs. Indeed, a lack of medical knowledge of fasting and diabetes among general practitioners in France reportedly resulted in the provision of inaccurate advice to patients during Ramadan, alongside inadequate patient education [14]. The EPIDIAR study, which was carried out across 13 Muslim-majority countries, revealed that around a third of HCPs did not provide any recommendations at all about fasting during Ramadan to their Muslim patients with diabetes [9]. There are signs that awareness of recommendations and guidelines are increasing; however, in Muslim-minority countries, the evidence suggests that use of guidelines remains low [11, 15]. Studies have also shown a lack of awareness of Ramadan guidelines among pharmacists [16, 17]. One study in Qatar found that less than half of pharmacists referred to published practice guidelines, and only 20% and 8% were aware of and had read the American Diabetes Association (ADA) consensus document on fasting during Ramadan and the decree of the Organisation of Islamic Conference, respectively [16]. Interestingly, 20% of pharmacists interviewed were concerned about offering advice contradictory to that provided by the physician [16]. The views of others may raise a significant barrier to guideline implementation, and some HCPs may find it hard to accept guidance that conflicts with the opinions of colleagues or indeed their own religious beliefs. A lack of training, both in general diabetes management and diabetes management during Ramadan, is also a critical issue [18].

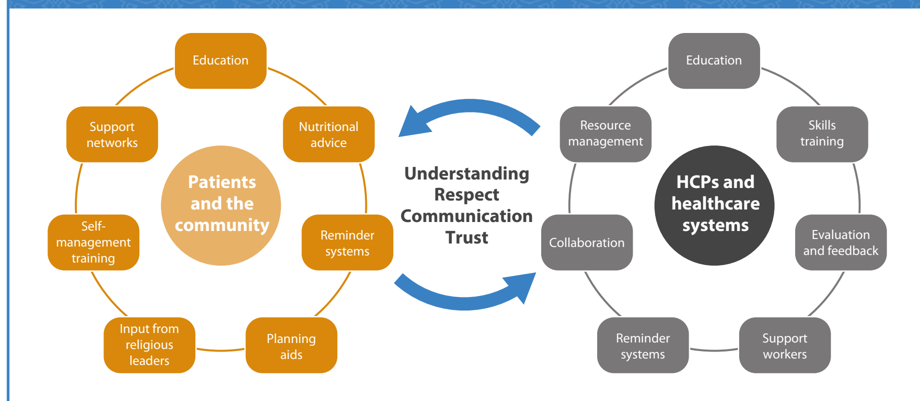


Across 13 Muslim-majority countries, around a third of HCPs did not provide any recommendations at all about fasting during Ramadan to their Muslim patients with diabetes

9.3 Overcoming barriers to guideline implementation

The first step in overcoming barriers to guideline implementation is to fully understand them; this enables appropriate practical responses to be configured and implemented. Many of the barriers could be overcome by the provision of comprehensive diabetes education, both for patients and HCPs (***Figure 2***). Combining targeted education with a series of further actions across communities and health services, such as skills training, improved communication, use of planning aids, establishment of support networks, and resource management, can together help foster stronger patient-doctor relationships; the basis for effective guideline implementation (***Figure 2***).

Figure 2. Multiple approaches for overcoming barriers to guideline implementation



9.3.1 Targeted diabetes education and building a good patient-doctor relationship

Ramadan-focused diabetes education is widely recommended and has proven to be effective, as discussed in Chapter 6 [7, 19]. In both Muslim-majority and Muslim-minority countries it may first be necessary to provide education to HCPs, to both increase their awareness of the range of guidelines available and to ensure they are providing optimal advice to patients for the management of diabetes during Ramadan. This can be achieved with the support of regional, national and international organisations. Moreover, encouraging specialists within healthcare systems to advocate such guidelines can both educate and motivate other health workers, as well as provide confidence among staff that a unified message is being disseminated. HCPs may also need additional training to ensure that they have the appropriate skills to deliver optimal diabetes management strategies to fasting individuals. Paramount to this is cultural sensitivity to the beliefs and attitudes of the patient, and effective communication between patient and doctor [20]. HCPs must take care to convey the importance of the patient's role in the management of their own diabetes, while being sensitive to socio-cultural circumstances [20]. Cultural competency minimises misunderstandings, resulting in better communication and overall care [21]. It can also empower providers to take practical steps to respond to patient values; for example, providing a female doctor or chaperone to female patients who may be uncomfortable seeing a male physician [22]. It can also be helpful for HCPs to monitor the adherence of patients to the diabetes advice provided (e.g. through the use of patient diaries); such information can be used to shape patient care according to patient behaviour, and to improve diabetes management during Ramadan [23]. For patient education, patient beliefs and current practices should be used as a foundation for building informative programmes, and education should be tailored to the recipients' culture and literacy [20, 24].

For example, when educating about diet, HCPs should have the knowledge to ensure that traditional foods and foods compatible with the patient's economic situation are included within dietary plans [24].



Cultural competency is essential for clear communication and better overall diabetes care

At a service level, improving accessibility to care, cross-discipline communication and continuity of care can help with the implementation of guidelines, by providing consistent messages to patients and ensuring the development of a trusting therapeutic alliance [20]. Services should take responsibility to raise awareness of available materials, both among staff and patients. Evaluation and audit of guideline implementation can provide opportunities to re-assess and improve implementation approaches [25]. Resources may be lacking in some low- or middle-income Muslim-majority countries and effective resource management is therefore necessary to ensure the provision of optimum diabetes care; collaboration within medical teams and the use of agreed protocols can be beneficial [26].

9.3.2 A collaborative approach to enhance guidance implementation

It is essential to involve religious leaders in community-level educational programmes, alongside HCPs, to ensure that patients receive advice combining religious and medical directives [27]. Religious leaders have access to a large proportion of the community and the information they provide is considered trustworthy. Studies involving focus-groups have suggested that imams are keen to work with and support HCPs in providing general diabetes prevention advice within their religious teaching [28, 29]. Incorporating fasting-specific diabetes advice into teachings would provide a valuable means to disseminate this information. In a small study that examined the fasting practices of pregnant women with diabetes, individuals were as likely to seek advice from their imam as from an HCP [30]. It is vital, therefore, that imams have a sound understanding of the issues surrounding diabetes management during Ramadan, in order to provide accurate information to patients. Over half of the participants in the study involving pregnant women with diabetes did not consult either an HCP or a religious leader prior to Ramadan [30]. This highlights the need for proactive action by healthcare systems and HCPs to provide education and support to this community rather than waiting for patients to seek out advice. The involvement of community support workers in community-centric educational programmes can also help to reshape traditional views and drive successful outcomes, as demonstrated in the Ramadan Education and Awareness in Diabetes programme (see Chapter 6) [7].

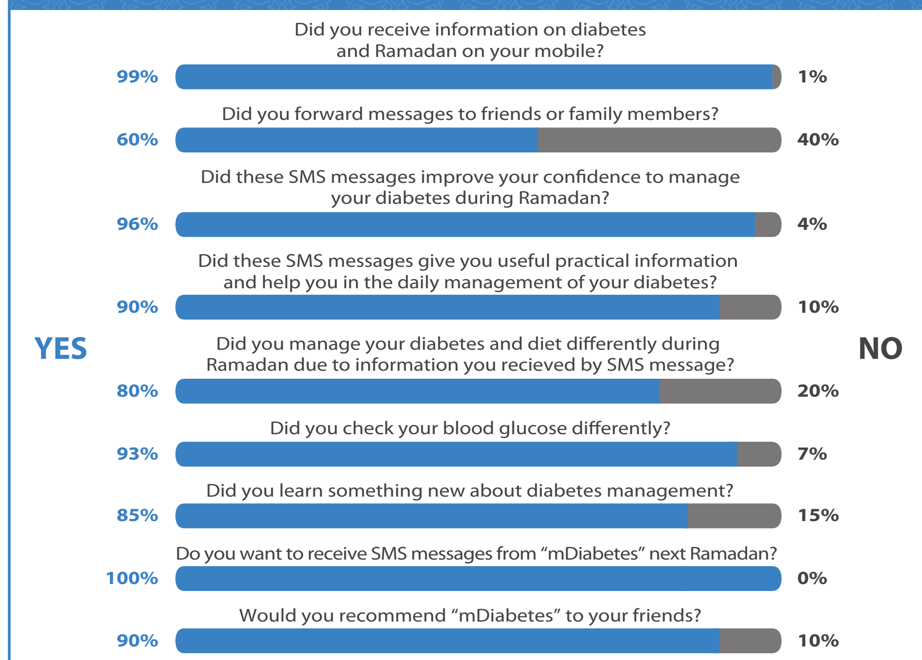


Providing Ramadan-focused diabetes education should be a collaborative process involving HCPs, religious leaders and community support workers

Overall, multiple strategies for raising awareness of the issues of diabetes management during Ramadan should be encouraged. Ultimately, education of all stakeholders is fundamental in ensuring the provision of optimal diabetes management, especially during Ramadan.

9.3.3 The use of technology to improve diabetes management during Ramadan

Technology can be a useful tool for improving diabetes management [31]. For example, services could adopt reminder systems to remind HCPs to provide Ramadan fasting advice to each patient in their pre-Ramadan consultations. Owning a mobile phone is commonplace these days, therefore mobile messaging and applications could be used to promote disease awareness and to provide support for diabetes self-management, including medication reminders and diet and lifestyle plans [31]. To this end, the World Health Organization and the International Union of Telecommunications have implemented the 'Be He@lthy, Be Mobile' initiative which seeks to use mobile technology to fight the growing global burden of non-communicable diseases including diabetes [32]. The mDiabetes project was one such approach that was launched in Senegal in 2014 [33]. Patients with diabetes, HCPs and the general public were encouraged to sign up to receive a special set of 'Diabetes & Ramadan' SMS before, during and after Ramadan. The aim of these text messages was to increase awareness of diabetes and provide advice during Ramadan to prevent complications associated with fasting and feasting. In 2014, around 3,000 people had registered to receive the messages, and this increased to 11,000 in 2015. It is projected that 50,000 adults will be registered for this service in 2016. In collaboration with the Senegalese Association for the Support of People with Diabetes (Association Sénégalaise de Soutien aux Diabétiques; ASSAD), the acceptance of the SMS health campaign was qualitatively evaluated nine months after the 2014 campaign. During the evaluation a random sample of 100 patients with diabetes who had registered for the SMS service were interviewed by phone. The outcome was very positive, confirming the high interest within the diabetes community to receive simple daily advice on a personal device to help manage their diabetes during Ramadan and fast safely (***Figure 3***). The mDiabetes project has also been launched in Egypt [34].



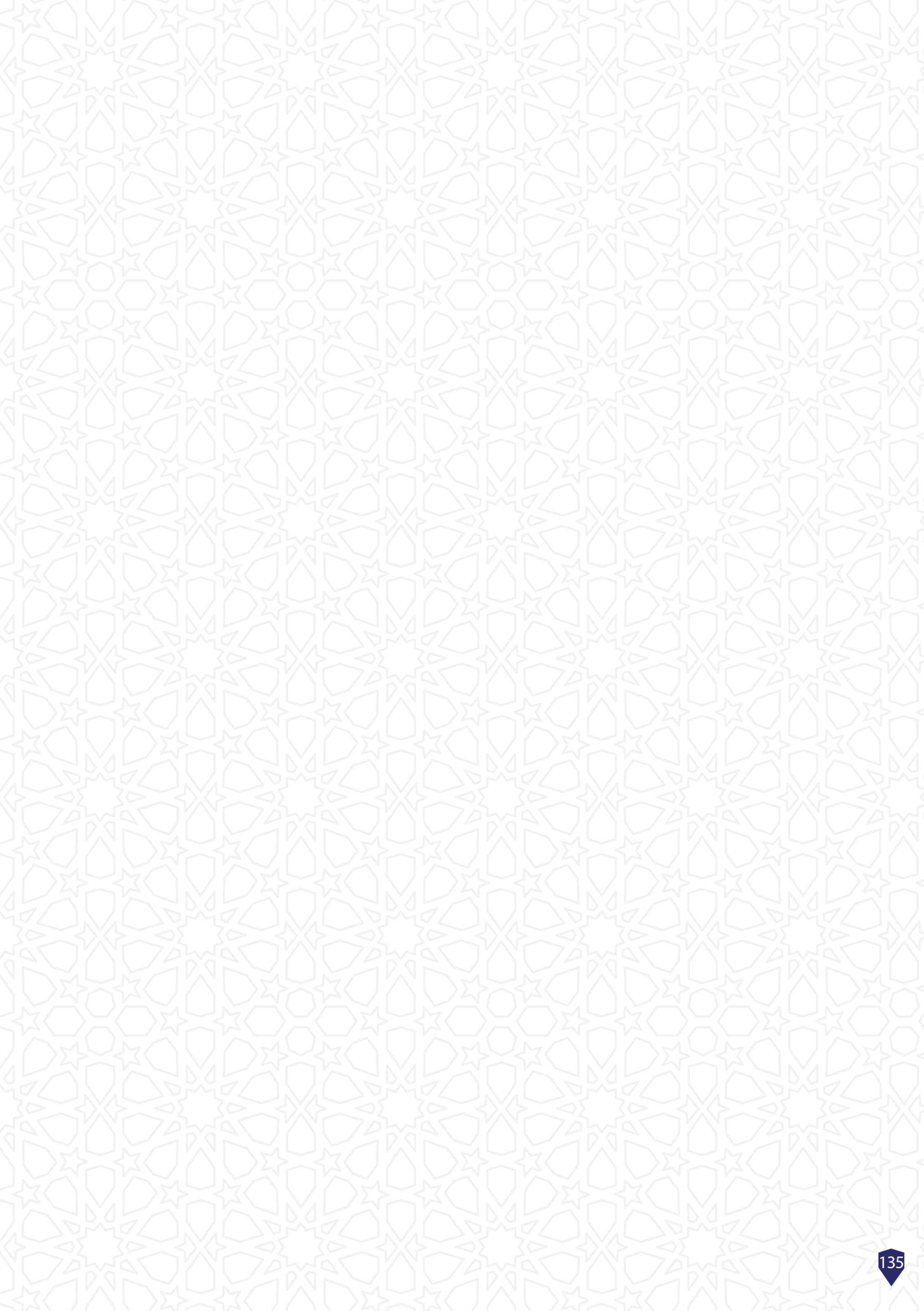
Summary

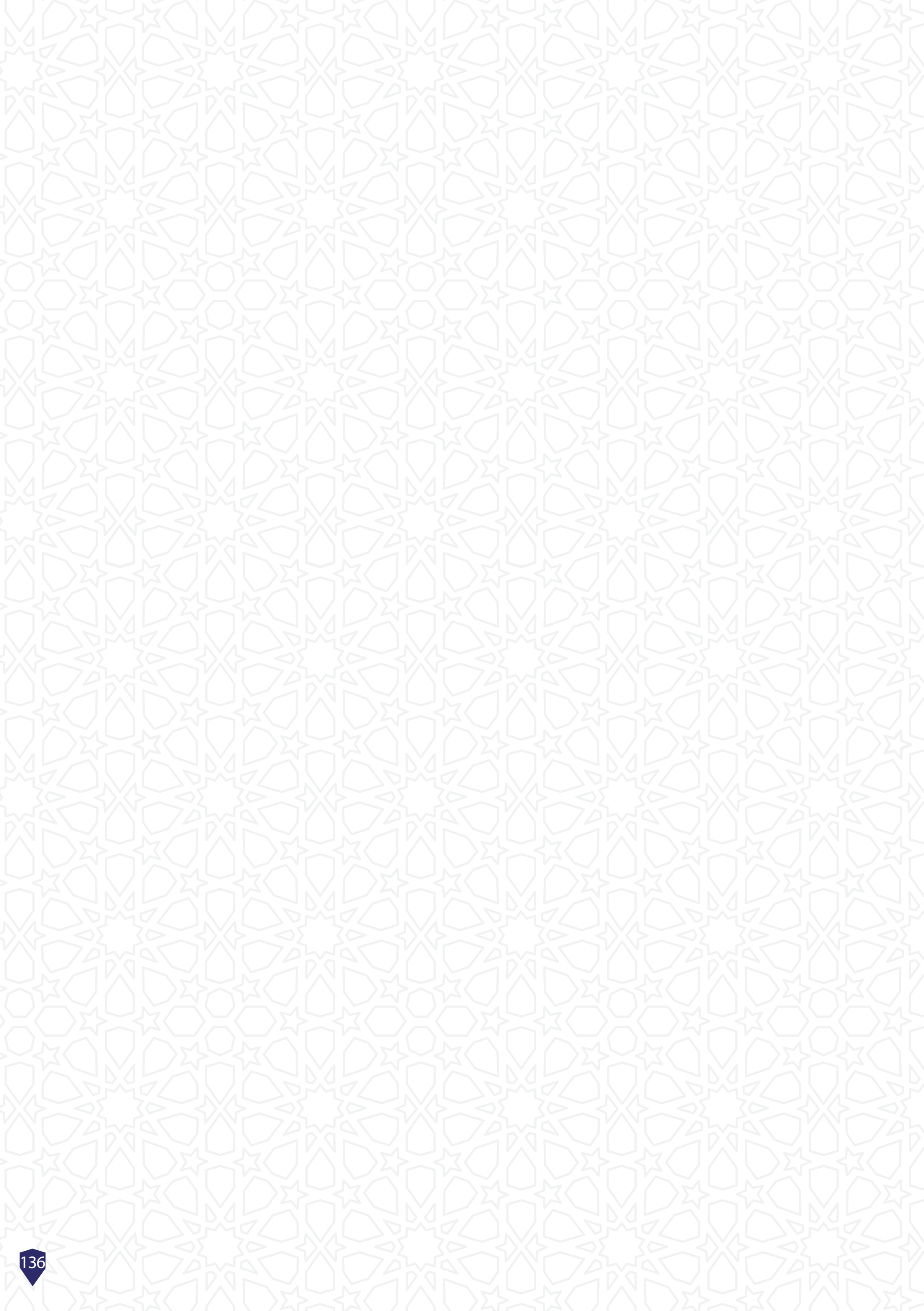
- Diabetes guidelines and educational resources such as the *IDF-DAR Practical Guidelines* are only of value if they are adhered to by both HCPs and patients.
- Several barriers to guideline implementation have been identified, originating within the individual (the patient or HCP) or within the wider cultures of the community or healthcare system.
- Key solutions to overcoming such barriers include raising HCP awareness of the key issues surrounding diabetes management during Ramadan, and providing effective, socio-culturally sensitive patient education.
- Technology can play a key role in the dissemination of diabetes management advice and guideline recommendations – as demonstrated by the mDiabetes project.

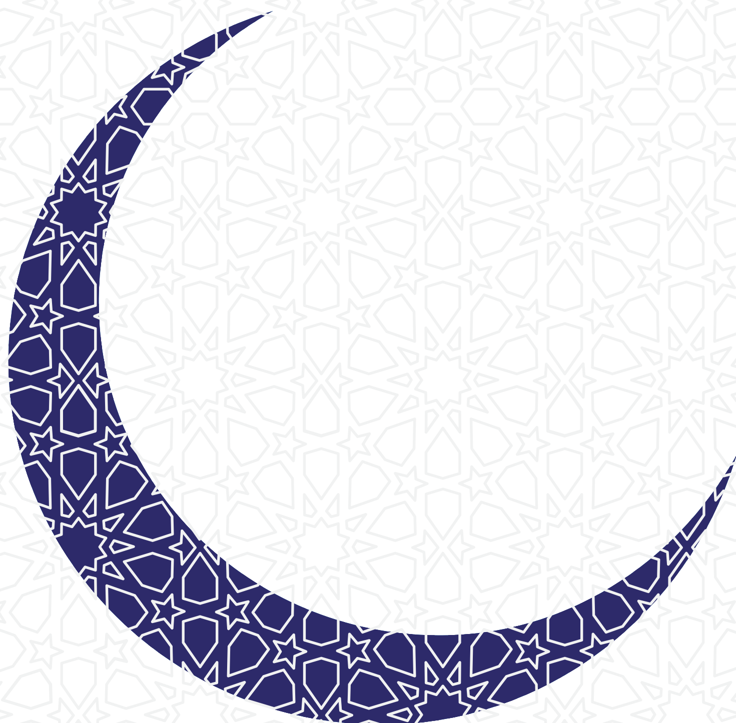
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Appendix.





جمهورية مصر العربية
وزارة العدل
دار الإفتاء المصرية
مكتب المفتي

﴿فَسْـَٔلُوٓاْ أَهْلَ ٱلذِّكْرِ إِن كُنتُمْ لَا تَعْلَمُونَ﴾ [النحل: ٤٣]

(الحمد لله وحده والصلاة والسلام على من لا نبي بعده سيدنا محمد رسول الله وعلى آله وصحبه ومن تبعه بإحسان إلى يوم الدين)

اطلعنا على الطلب المُقدَّم من/ مؤسسة دار بتاريخ: ٢٠١٦/٣/٨م

المُقيَّد برقم ٩٢ لسنة ٢٠١٦م، والمتضمن:

ما حكم الصيام لمرضى السكر على اختلاف درجاتهم، حيث تم تقسيمهم طبيًّا إلى ثلاث فئات:

الفئة الأولى: المرضى ذوو الاحتمالات الكبيرةِ جدًّا للمضاعفات الخطيرة بصورةٍ شبه مؤكدةٍ طبيًّا، وهذه الفئة يقول المتخصصون بأنها معرضة لحصول ضررٍ بالغٍ عند الصيام.

الفئة الثانية: المرضى ذوو الاحتمالات الكبيرة للمضاعفات نتيجة الصيام، وهذه الفئة يغلب على ظن الأطباء المتخصصين وقوع ضررٍ بالغٍ عليهم عند الصيام.

الفئة الثالثة: المرضى ذوو الاحتمالات المتوسطة أو المنخفضة للتعرض لمضاعفاتٍ نتيجة الصيام.

فما حكم الصوم لهذه الفئات على اختلاف درجاتهم؟

الجـــــــــواب:

الصوم فريضةٌ من فرائض الإسلام أناطها الله تعالى بالاستطاعة؛ فإذا لم يستطع المسلمُ الصومَ بالامتناع عن المفطرات من الطعام والشراب ونحوهما من الفجر إلى المغرب، فإن له رخصة الإفطار، بل إذا كان الصوم يضُرّ بصحته -بقول الأطباء المتخصصين- فيجب عليه أن يفطر؛ حفاظًا على صحته؛ قال تعالى: ﴿وَمَا جَعَلَ عَلَيْكُمْ فِي الدِّينِ مِنْ حَرَجٍ﴾ [الحج: ٧٨]، وقال تعالى: ﴿وَلَا تُلْقُوا بِأَيْدِيكُمْ إِلَى التَّهْلُكَةِ﴾ [البقرة: ١٩٥]، وقال سبحانه في خصوص الصوم: ﴿يُرِيدُ اللهُ بِكُمُ الْيُسْرَ وَلَا يُرِيدُ بِكُمُ الْعُسْرَ﴾ [البقرة: ١٨٥]، وعن أبي هريرة رضي الله عنه عن النبي صلى الله عليه وآله وسلم قال: «وَإِذَا أَمَرْتُكُمْ بِأَمْرٍ فَأْتُوا مِنْهُ مَا اسْتَطَعْتُمْ» متفقٌ عليه.

Web Site : http://www.dar-alifta.org
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العنوان: حديقة الخالدين - الدراسة - القاهرة ص ب ١١٦٧٥
التليفون: ١٠٧/ الفاكس: ٢٥٩٢٦١٤٣ - ٢٠٢

٤٦٢٠٥

ويقول الله تعالى: ﴿فَمَنْ كَانَ مِنْكُمْ مَرِيضًا أَوْ عَلَى سَفَرٍ فَعِدَّةٌ مِنْ أَيَّامٍ أُخَرَ وَعَلَى الَّذِينَ يُطِيقُونَهُ فِدْيَةٌ طَعَامُ مِسْكِينٍ﴾ [البقرة: ١٨٤]، والمعنى: أنه يُرَخَّص للمسلم المكلَّفِ المريضِ مرضًا يُرجَى بُرؤُه ولا يستطيع معه الصومَ -وللمسافرِ كذلك- الإفطارُ في رمضان، ثم عليهما القضاءُ بعد زوال العذر والتمكن من الصيام.

فإن كان المرض طارئًا فعلى المسلم أن يقضي ما أفطره عندما يزول العارض، أما إذا كان مريضًا مرضًا لا يُرجَى شفاؤه -وهو ما يُعرَف بالأمراض المزمنة- ولا يَقْوَى معه على الصيام، أو كان كبيرًا في السن؛ بحيث يعجز عن الصيام وتلحقه مشقة شديدة لا تُحتَمَل عادةً فلا يجب عليه الصيام، وعليه فدية؛ إطعامُ مسكين عن كل يوم من الأيام التي يفطرها من رمضان، وقدر هذه الفدية مُدٌّ من الطعام

ومرض السكر على اختلاف درجاته هو من الأمراض المزمنة، ومعرفة أحكام مرضاه من جهة الصوم الواجب مبنية على معرفة طرق العلاج المتاحة لهم طبيًّا في كل فئة من الفئات المذكورة.

فإن غلب على ظن المريض أنه إن صام حصلت له مشقة، أو صام ثم حصلت له المشقة؛ سواء باشتداد وطأة المرض عليه، أم احتاج إلى تناول الدواء، أم غلبه الجوع أو العطش -وهذا هو حال غالب مرضى السُّكَّر- جاز له أن يفطر، بل ويجب عليه أن يفطر إذا خشي على نفسه من الهلاك؛ لقول الله تعالى: ﴿وَلَا تَقْتُلُوا أَنْفُسَكُمْ إِنَّ اللهَ كَانَ بِكُمْ رَحِيمًا﴾ [النساء: ٢٩]، وقوله تعالى: ﴿وَلَا تُلْقُوا بِأَيْدِيكُمْ إِلَى التَّهْلُكَةِ﴾ [البقرة: ١٩٥].

قال العلّامة الخطيب الشربيني في "مغني المحتاج" (٢/١٦٩، ط. دار الكتب العلمية): [وإن عاد المرض واحتاج إلى الإفطار أفطر، ويجب الفطر إذا خشي الهلاك؛ كما صرح به الغزالي وغيره، وجزم به الأذرعي، ولمن غلبه الجوع أو العطش حكم المريض] اهـ.

وبناء على ذلك وفي واقعة السؤال: فإن أحكام الصيام لفئات مرضى السكر مترتبة على الطرق العلاجية التي يمكن التعامل بها مع كل فئة بما يناسبها على التفصيل المذكور.

مجدي عاشور

العنوان: حديقة الخالدين - الدراسة - القاهرة ص . ب : ١١٦٧٥
التليفون: ١٠٧/ الفاكس: ٢٥٩٢٦١٤٣- ٢٠٢
Web-Site : http://www.dar-alifta.org
Email : fatawa@dar-alifta.org

فإذا تأكدت احتمالات الضرر من الصيام لمريض السكر -كما هو مذكور في الفئة الأولى- وجب على المريض طاعة الطبيب في الإفطار، ويأثم إن صام.

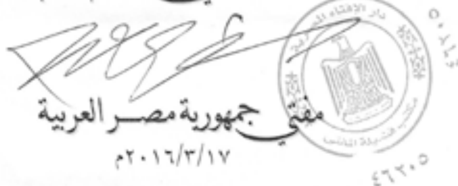
وإذا غلب احتمال الضرر على ظن الأطباء المتخصصين -كما هو مذكور في الفئة الثانية- وجب الإفطار وطاعة الطبيب كذلك؛ لأن المَظِنَّة تُنَزَّل منزلة المَئِنَّة.

أما إذا كان احتمال الضرر من الصوم متوسطًا أو ضعيفًا -كما في الفئة الثالثة-: فإن الأخذ برخصة الإفطار حينئذٍ يكون أمرًا تقديريًّا؛ أي أن مرجعه في معرفة ضرر الصوم وما قد يجره عليه من أذًى هو إلى الطبيب المتخصص من جهة معرفة حالته ومضاعفاتها، وإلى المريض من جهة طاقته وقدرته على الصيام واحتماله له؛ فيُقدِّر الطبيب مدى تأثير الصوم على حالة المريض من حيث إمكانية الصوم من عدمه، ويقدر المريض مدى قدرته واحتماله للصوم.

مع التنبيه على أنه يجب على المريض في كل فئة من هذه الفئات الثلاث أن يستجيب للطبيب إن رأى ضرورة إفطاره وخطورة الصوم عليه.

والله سبحانه وتعالى أعلم

أ.د/ شوقي إبراهيم علام



مفتي جمهورية مصر العربية

٢٠١٦/٣/١٧م

Translation to summary of the response of Egypt's Mofty to diabetes and Ramadan risk categories religious ruling

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In the Name of Allah, the Most Gracious, the Most Merciful

The Arab Republic of Egypt
Ministry of Justice
Dar Al-Iftaa Al Missriyyah
Mufti's Office

(***If ye realise this not, ask of those who possess the Message***) [Al-Nahel: 43]

(*All praise is due to Allah, May the peace and blessings of Allah be upon our Prophet Muhammad, his family and companions, and all those who follow them in the righteousness till the Day of Judgment*.)

We have reviewed the application submitted by/ DAR Establishment on 08/03/2016 AD

Recorded under No. 92 of 2016, which reads as follows:

What is the ruling *"stance of the Shari'ah"* on fasting for diabetics of different types, where they are medically categorized as three types;

Type 1: diabetics who are very highly prone to risk of **serious complications**, as medically confirmed. The specialists say that such category is prone to serious risk in case of fasting.

Type 2: diabetics who are highly prone to **complications** due to fasting. The specialists think that such category might suffer from serious injury in case of fasting.

Type 3: diabetics who **are at moderate or low risk to complications** due to fasting.

What is the ruling *"stance of the Shari'ah"* on fasting of the three types?

Answer:

The fast (*Sawm*) is one of the religious obligations "*Pillars*" of Islam, which have been ordained by Allah as per ability, if a Muslim could not fast by restraining from eating and drinking and such things from the dawn (*Fajr*) till sunset (*Maghreb*), then he is permitted to break the fast. Further, if fast will harm any person, as said by specialist physicians, then he must break the fast in order to save his health. Allah Almighty says "*and has imposed no difficulties on you in religion*" [Al Hajj: 78], Allah Almighty Says also "*and make not your own hands contribute to (your) destruction*" [Al Baqara: 195], and with regard to fast (*Sawm*), Allah Almighty says "*Allah intends every facility for you; He does not want to put to difficulties*" [Al Baqara: 185]. Moreover, Abu Huraira, *May Allah be pleased with him*, narrated that the Prophet, *May Peace and Mercy be upon him*, said "*And if I order you to do something, then do of it as much as you can*" [agreed upon].

Allah Almighty says "*but if any of you is ill, or on a journey, the prescribed number (Should be made up) from days later. For those who can do it (With hardship), is a ransom, the feeding of one that is indigent*" [Al Baqara: 184]. This means that an adult Muslim who is suffering from curable disease with which he cannot fast, and the traveler as well, are permitted to break the fast and then they should make up these days after abatement of the excuse and being able to fast.

If this illness is emergent, a Muslim should make up the days at which he broke the fast when such emergency disappears, but if he is suffering from a cureless disease, which are known as chronic diseases, because of which he cannot fast or if he is old and cannot fast as he suffers from unbearable discomfort, then he is not obliged to fast but he should do ransom by feeding one that is indigent for each day he breaks the fast in Ramadan.

Later, if he becomes able to fast, he should not make up these days and he should only do the ransom because he is initially addressed due to his said case.

The diabetes disease, of all its types, is a chronic one. The rulings of fast for diabetics are based on knowing the way of available treatment for each type.

If the patient thinks that if he fasts he will suffer, or if he fasts and suffers, where the illness gets tougher or he needs to take the medications or he becomes very hungry or thirsty, as happens with most of the diabetics, then he is permitted to break the fast. Furthermore, he must break the fast if he is afraid of serious harm, where Allah Almighty says "*And do not kill yourselves [or one another]. Indeed, Allah is to you ever Merciful.*" [An-Nissa: 29] and Allah Almighty says "*and make not your own hands contribute to (your) destruction*" [Al Baqara: 195].

By applying the above to this question, the rulings of fast for diabetics depends on the ways of treatment where each type needs to be treated as per its suitable treatment as detailed above.

If it is confirmed that fast will cause harm to the diabetics, as stated in the first type, the patient should obey the physician and break the fast, otherwise he will be sinner.

If the specialist physicians think that the patient might be harmed, as stated in the second type, then the patient should break the fast and obey the physician, because the doubt should be regarded as the prevailing rule.

If the possibility of injury due to fast is moderate or low, as in the third type, then adopting the permission for breaking the fast will be discretionary matter, where the harm resulting from the fast will be determined by the specialist physician according to the patient's case and its complications, and by the patient according to his ability and endurance to fast. The physician will estimate the effect of fast on the patient, whether he will be able to fast or not, and the patient will estimate his ability and endurance to fast.

It is worthy to be noted that in all the three types, the patient should follow the physician's prescription if he finds that he should break the fast and that fast is risky for him.

Allah the Almighty knows best.

Prof. Shawky Ibrahim Allam
signed and sealed (on all Pages)
Mufti of the Arab Republic of Egypt
17/03/2016

Signed By : Majdi Ashour **(on all pages)**

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